Hardware Installation Manual · Edition 04/2006

Power Module

PM240

SINAMICS

G120

SIEMENS

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SINAMICS

SINAMICS G120
Power Modules PM240

Hardware Installation Manual

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Safety Guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

Danger

indicates that death or severe personal injury **will** result if proper precautions are not taken.

Warning

indicates that death or severe personal injury **may** result if proper precautions are not taken.

Caution

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

Caution

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

Notice

indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Prescribed Usage

Note the following:

Warning

This device may only be used for the applications described in the catalog or the technical description and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens. Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

Trademarks

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction

1

1.1 Documents for the SINAMICS G120

Available documentation

The following documents are available for the SINAMICS G120 inverters:

- Brochure
- Catalog
- Getting started Guide
- Operating Instructions
- Hardware Installation Manual
- Compact Operating Instructions (for the Control Units)
- Parameter List.

The documents can be downloaded from the Internet via the following link:
http://www.siemens.de/sinamics-g120

Description of the documents

Brochure

The brochure is advertising literature designed to introduce the product to the marketplace. It contains a basic outline of the product with a brief overview of the technical capabilities of the product.

Catalog

The catalog presents information that allows the customer to select an appropriate inverter including all available options. It contains detailed technical specifications, ordering and pricing information to allow the customer to order the appropriate items for their application or plant.

Getting started Guide

The Getting started Guide presents warnings, dimension drawings and a brief set up information for the customer.

Operating Instructions

The Operating Instructions gives information for the Control Unit regarding the features of the product. It gives detailed information on commissioning, control modes, system parameters, troubleshooting, technical specifications and the available options from the product.

Hardware Installation Manual

The Hardware Installation Manual gives information for the Power Modules regarding the features of the product. It gives detailed information on installation, technical specifications, dimension drawings and the available options from the product.

Compact Operating Instructions

The Compact Operating Instructions gives a brief description of the installation, commissioning and control modes as well as an overview of troubleshooting, technical specifications and the available options from the product.

Parameter List

The Parameter List contains a detailed description of all the parameters that can be modified and adapted for specific applications. The Parameter List also contains a series of function diagrams to diagramatically portray the nature and interoperability of the system parameters.

Safety notes

2

Safety Instructions

The following Warnings, Cautions and Notes are provided for your safety and as a means of preventing damage to the product or components in the connected machines. This section lists Warnings, Cautions and Notes, which apply generally when handling the SINAMICS G120 product, classified as General, Transport and Storage, Commissioning, Operation, Repair and Dismantling and Disposal.

Specific Warnings, Cautions and Notes that apply to particular activities are listed at the beginning of the relevant sections in this manual and are repeated or supplemented at critical points throughout these sections.

Please read the information carefully, since it is provided for your personal safety and will also help prolong the service life of your SINAMICS G120 product and the equipment to which it is connected.

General

Caution

Children and the general public must be prevented from accessing or approaching the equipment!

This equipment may only be used for the purpose specified by the manufacturer. Unauthorized modifications and the use of spare parts and accessories that are not sold or recommended by the manufacturer of the equipment can cause fires, electric shocks and injuries.

Notice

Keep these operating instructions within easy reach of the equipment and make them available to all users.

Whenever measuring or testing has to be performed on live equipment, the regulations of Safety Code BGV A2 must be observed, in particular § 8 "Permissible Deviations when Working on Live Parts". Suitable electronic tools should be used.

Before installing and commissioning, please read these safety instructions and warnings carefully and all the warning labels attached to the equipment. Make sure that the warning labels are kept in a legible condition and replace missing or damaged labels.

Risk of electric shock

Warning

This equipment contains dangerous voltages and controls potentially dangerous rotating mechanical parts. Non-compliance with the Warnings or failure to follow the instructions contained in this manual can result in loss of life, severe personal injury or serious damage to property.

Only suitable qualified personnel should work on this equipment, and only after becoming familiar with all safety notices, installation, operation and maintenance procedures contained in this manual. The successful and safe operation of this equipment is dependent upon ist proper handling, installation, operation and maintenance.

Take particular notice of the general and regional installation and safety regulations regarding work on dangerous voltage installation (e.g. EN 50178) as well as the relevant regulations regarding the correct use of tools and personal protective equipment (PPE).

Risk of electric shock

The line input, DC and motor terminals can carry dangerous voltages even if the SINAMICS G120 inverter is inoperative. Wait five minutes to allow the unit to discharge after switching off the line supply before carrying out any installation work.

The terminals can carry dangerous voltages, even after the inverter has become inoperative. Depending on the frame size the following terminals are for:

- the power supply L/U1/L1, N/V1/L2 and W1/L3
- the motor ⏚, U2, V2, W2
- and DCN, DCP/R1, R2.

HP ratings are based on the Siemens 1LA motors and are given for guidance only. They do not necessarily comply with UL or NEMA HP ratings.

Transport and storage

Warning

Correct transport, storage as well as careful operation and maintenance are essential for the proper and safe operation of the equipment.

Caution

Protect the equipment against physical shocks and vibration during transport and storage. It is important that the equipment is protected from water (rainfall) and excessive temperatures.

Commissioning

Warning

Working on the equipment by unqualified personnel or failure to comply with warnings can result in severe personal injury or serious damage to material. Only suitably qualified personnel trained in the setup, installation, commissioning and operation of the product should carry out work on the equipment.

Caution

The control cables must be laid separately from the power cables. Carry out the connections as shown in the installation section in this manual, to prevent inductive and capacitive interference from affecting the correct function of the system.

Mechanical installation

Warning

To ensure the safe operation of the equipment, it must be installed and commissioned by qualified personnel in full compliance with the warnings laid down in this manual.

Take particular note of the general and regional installation and safety regulations regarding work on dangerous voltage installation (e.g. EN 61800-5-1) as well as the relevant regulations regarding the correct use of tools and personal protective equipment (PPE).

The line input, DC and motor terminals can carry dangerous voltages even if the SINAMICS G120 inverter is inoperative. Wait 5 minutes to allow the unit to discharge after switching off the line supply before carrying out any installation work.

Electrical installation

Warning

Power and motor connections

The SINAMICS G120 inverter must always be grounded. If the SINAMICS G120 inverter is not grounded correctly, extremely dangerous conditions may arise which could prove potentially fatal.

Isolate the mains electrical supply before making or changing connections to the unit.

Ensure that the SINAMICS G120 inverter is configured for the correct supply voltage – the SINAMICS G120 inverter must not be connected to a higher voltage supply.

When synchronous motors are connected or when coupling several motors in parallel, the SINAMICS G120 inverter must be operated with V/f control characteristics (P1300 = 0, 2 or 3).

Note

TT-/IT power systems can only be used with unfiltered drives.

Caution

Cables

The control cables must be laid separately from the power cables. The connection must be carried out as shown in the installation section in this manual, to prevent inductive and capacitive interference from affecting the correct function of the system.

Operation

Warning

The SINAMICS G120 inverters operate at high voltages.

When operating electrical devices, it is impossible to avoid applying hazardous voltages to certain parts of the equipment.

Emergency Stop facilities according to EN 60204, IEC 204 (VDE 0113) must remain operative in all operating modes of the control equipment. Any disengagement of the Emergency Stop facility must not lead to an uncontrolled or an undefined restart of the equipment.

Certain parameter settings may cause the SINAMICS G120 inverter to restart automatically after an input power failure, for example, the automatic restart function.

Wherever faults occurring in the control equipment can lead to substantial material damage or even grievous bodily injury (that is, potentially dangerous faults), additional external precautions must be taken or facilities provided to ensure or enforce safe operation, even when a fault occurs (e.g. independent limit switches, mechanical interlocks, etc.).

Motor parameters must be accurately configured for motor overload protection to operate correctly.

This equipment is capable of providing internal motor overload protection according to UL508C. Refer to P0610 and P0335, i^2t is ON by default.

This equipment is suitable for use in a circuit capable of delivering not more than 10,000 symmetrical amperes (rms), for a maximum voltage of 460 V when protected by an H, J or K type fuse, a circuit breaker or self-protected combination motor controller.

Repair

Warning

Repairs on equipment may only be carried out by Siemens Service, by repair centers authorized by Siemens or by authorized personnel who are thoroughly acquainted with all the warnings and operating procedures contained in this manual.

Any defective parts or components must be replaced using parts contained in the relevant spare parts list.

Disconnect the power supply before opening the equipment for access.

Dismantling and disposal

Caution

The SINAMICS G120s packaging is re-usable. Retain the packaging for future use.

Easy-to-release screw and snap connectors allow you to break the unit down into its component parts. You can recycle these component parts, dispose of them in accordance with local requirements or return them to the manufacturer.

Description

3

Overview

The SINAMICS G120 inverter has been designed for the accurate and efficient control of the speed and torque for three-phase motors. The SINAMICS G120 system comprises two basic modules, the Control Unit (CU) and the Power Module (PM).

Control Units

- CU240S

  Control Unit for operation via terminals

- CU240S DP

  Control Unit for operation via terminals or PROFIBUS DP Communication

- CU240S DP-F

  Control Unit with fail-safe functions for operation via terminals or PROFIBUS DP Communication (PROFIsafe).

Power Modules

- PM240 400 V, IP20
  - Frame sizes A unfiltered
  - Frame sizes B … F unfiltered or with filter Class A.

PM240 power modules can be used for control units with and without fail-safe funtions.

3.1 SINAMICS G120 Power Modules - PM240

Overview

There are the following types of SINAMICS G120 power modules for different applications.

- **PM240 power modules with braking capability (resistive braking)**
  - 380 V … 400 V, IP20, Frame sizes A … C unfiltered, 0,37 kW … 11 kW
  - 380 V … 400 V, IP20, Frame sizes D … F unfiltered, 15 kW … 75 kW
  - 380 V … 400 V, IP20, Frame sizes B … F unfiltered or filter Class A, 2,2 kW … 11 kW
  - 380 V … 400 V, IP20, Frame sizes D … F unfiltered or filter Class A, 15 kW … 75 kW.

3.2 Power Range of SINAMICS G120 power modules PM240

Power range of SINAMICS G120 power modules PM240

Table 3-1 SINAMICS G120 power modules PM240

Power Module	Power Rating	Power Rating	Voltage	Filtered	Unfiltered
	kW	Hp	V		
PM240 FSA	0.37 … 1.5	0.5 … 2.0	380 … 400	--	✓
PM240 FSB	2.2 … 4.0	3.0 … 5.0	380 … 400	✓	✓
PM240 FSC	5.5 … 11.0	7.5 … 15.0	380 … 400	✓	✓
PM240 FSD	15.0 … 22.0	20.0 … 30.0	380 … 400	✓	✓
PM240 FSE	30.0 … 37.0	40.0 … 50.0	380 … 400	✓	✓
PM240 FSF	45.0 … 75.0	60.0 … 100.0	380 … 400	✓	✓

3.3 Block diagram PM240

Block diagram PM240

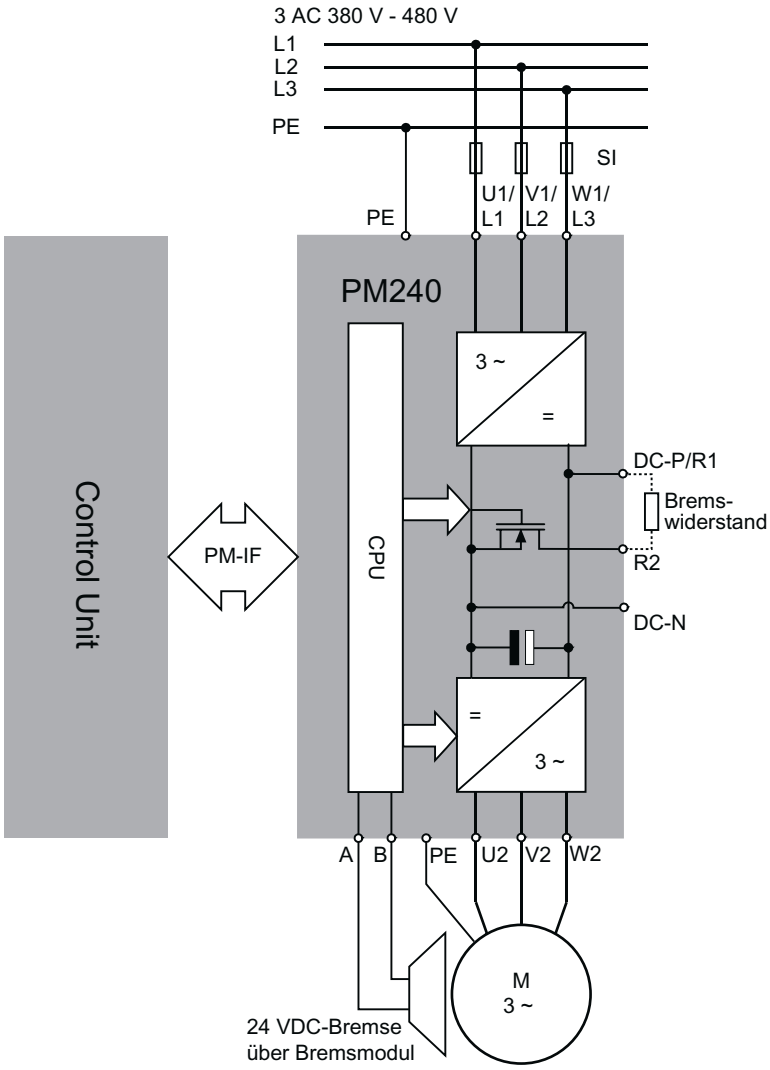


Figure 3-1 Power Module PM240

3.4 Accessories for the SINAMICS G120

Overview

The following options are available for the SINAMICS G120 Inverters:

Control Unit accessories

- OP (Operator Panel)
- PC connection kit
- MMC (Multi Media Card)
- CU screening Kit

Power Module accessories

- DIN rail mounting kit
- NEMA 1 kit
- Screen termination kit
- Brake and Safe brake modules
- Chokes
- Filters
- Braking resistor.

Power Module spare parts

- Fan.

A description of the individual options, there purposes and ordering information is given in the SINAMICS G120 catalog.

Installing/Mounting

4

Overwiew

This section gives an overview about the installation of the SINAMISCS G120 Power Modules. For technical details please refer to "Technical Data".

4.1 Mechanical Installation

Mechanical installation

Warning

To ensure the safe operation of the equipment, it must be installed and commissioned by qualified personnel in full compliance with the warnings laid down in this manual.

Take particular note of the general and regional installation and safety regulations regarding work on dangerous voltage installation (e.g. EN 61800-5-1) as well as the relevant regulations regarding the correct use of tools and personal protective equipment (PPE).

The line input, DC and motor terminals can carry dangerous voltages even if the SINAMICS G120 inverter is inoperative. Wait 5 minutes to allow the unit to discharge after switching off the line supply before carrying out any installation work.

Distances to other equipment

When mounting the SINAMICS G120 Power Modules one above the other or side by side, the specified environmental conditions must not be exceeded. Independent of this, these minimum distances of the SINAMICS G120 Power Modules must be observed:

Table 4-1 Distances to other equipment

Frame Size	A		B		C		D		E		F	
	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
Side by Side	30	1.18	40	1.57	50	1.96	0	0	0	0	0	0
Above and Below	100	3.93	100	3.93	125	4.92	300	11.81	300	11.81	350	13.77

Drill patterns for SINAMICS G120 power modules FSA to FSF

To allow the preliminary installation work to be undertaken, drill patterns for all the frame sizes of the SINAMICS G120 power modules are shown below.

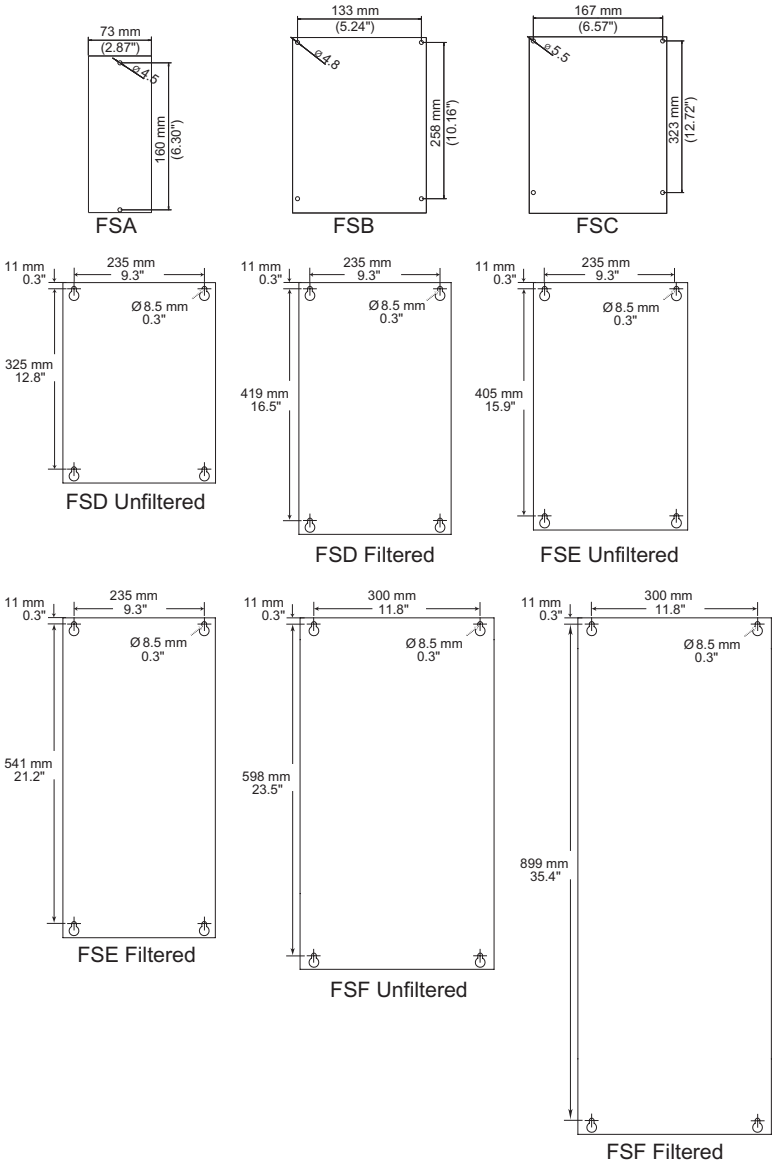


Figure 4-1 Drill patterns for SINAMICS G120 power modules FSA to FSF

Dimensions and tightening torques of SINAMICS G120 power modules

The dimensions and tightening torques for securing the inverter are given in the table below.

Table 4-2 Dimensions and tightening torques of SINAMICS G120 power modules

Frame size	Dimensions	Height x Width x Depth (H x W x D)		Fixing method	Tightening torques
		(with CU)	(without CU)		
A	mm	173 x 73 x 210	173 x 73 x 145	2 x M4 bolts, 2 x M4 nuts, 2 x M4 washers	2.5 Nm (22.1 lbf.in) with washers fitted.
	inch	6.81 x 2.87 x 8.27	6.81 x 2.87 x 5.71		
B	mm	270 x 153 x 230	270 x 153 x 165	4 x M4 bolts, 4 x M4 nuts, 4 x M4 washers	
	inch	10.63 x 6.02 x 9.05	10.63 x 6.02 x 6.50		
C	mm	334 x 189 x 250	334 x 189 x 185	4 x M5 bolts, 4 x M5 nuts, 4 x M5 washers	
	inch	13.1 x 7.41 x 9.84	13.1 x 7.41 x 7.28		
D Unfiltered	mm	419 x 275 x 260	419 x 275 x 204	4 x M6 bolts, 4 x M6 nuts, 4 x M6 washers	6 Nm (53 lbf.in) with washers fitted.
	inch	16.3 x 10.8 x 10.2	16.3 x 10.8 x 8.0		
D Filtered	mm	512 x 275 x 260	512 x 275 x 204		
	inch	20.1 x 10.8 x 10.2	20.1 x 10.8 x 8.0		
E Unfiltered	mm	499 x 275 x 260	499 x 275 x 204		
	inch	19.6 x 10.8 x 10.2	19.6 x 10.8 x 8.0		
E Filtered	mm	635 x 275 x 260	635 x 275 x 204		
	inch	25.0 x 10.8 x 10.2	25.0 x 10.8 x 8.0		
F Unfiltered	mm	635 x 350 x 372	635 x 350 x 316	4 x M8 bolts, 4 x M8 nuts, 4 x M8 washers	13 Nm (115 lbf.in) with washers fitted.
	inch	25.0 x 13.8 x 14.6	25.0 x 13.8 x 12.4		
F Filtered	mm	934 x 350 x 372	934 x 350 x 316		
	inch	36.8 x 13.8 x 14.6	36.8 x 13.8 x 12.4		

General rules for the environmental protection of the SINAMICS G120 Power Modules

To ensure that the SINAMICS G120 Power Module is installed in the correct environmental conditions, please ensure that you adhere to the following guidelines:

- The SINAMICS G120 Power Module is designed for IP20 protection only, this means:
  - It is protected from the ingress of solid foreign objects ≥ 12.5 mm (0.49 inches).
  - It is designed to not allow access to hazardous parts with a finger.
  - It is not protected against the ingress of water.
- Keep the SINAMICS G120 Power Module free from dust and dirt.
- Keep the SINAMICS G120 Power Module away from water, solvents and chemicals.
- Keep the SINAMICS G120 Power Module within the maximum and minimum operating temperatures.
- Ensure that the correct level of ventilation and air flow is provided.
- Ensure that good earthing/grounding practices are followed for each SINAMICS G120 Power Module and the cabinet.

Permissable Cable Length

All inverters will operate at full specification with cable lengths as follows:

- Screened 25 m (82 ft) for filtered drives
  50 m (164 ft) for unfiltered drives
- Unscreened 100 m (328 ft) for both filtered and unfiltered drives

Using output chokes as specified in the SINAMICS G120 catalog, the following cable lengths are possible:

Frame size	Max. permissable motor cable length for line voltage of			
	380 V … 400 V ± 10 %		400 V … 480 V ± 10 %	
	shielded	unshielded	shielded	unshielded
A	150 m	150 m	100 m	100 m
B … C	150 m	225 m	100 m	150 m
D … F	200 m	300 m	200 m	300 m

4.2 Electrical Installation

Electrical installation

Warning

Power and motor connections

The SINAMICS G120 inverter must always be grounded. If the SINAMICS G120 inverter is not grounded correctly, extremely dangerous conditions may arise which could prove potentially fatal.

Isolate the mains electrical supply before making or changing connections to the unit.

Ensure that the SINAMICS G120 inverter is configured for the correct supply voltage – the SINAMICS G120 inverter must not be connected to a higher voltage supply.

When synchronous motors are connected or when coupling several motors in parallel, the SINAMICS G120 inverter must be operated with V/f control characteristics (P1300 = 0, 2 or 3).

Power Distribution Systems

The power distribution systems described below, as defined in EN 60950, have been considered in the design of the inverter. In the next figures three phase systems are outlined. The PM240 three phase inverter must be connected to L1, L2 and L3. PE must always be connected. The PM240 will operate with most supply systems. In an IT Grid an output ground failure will lead to trip of the drive overload protection.

TN-S Power System

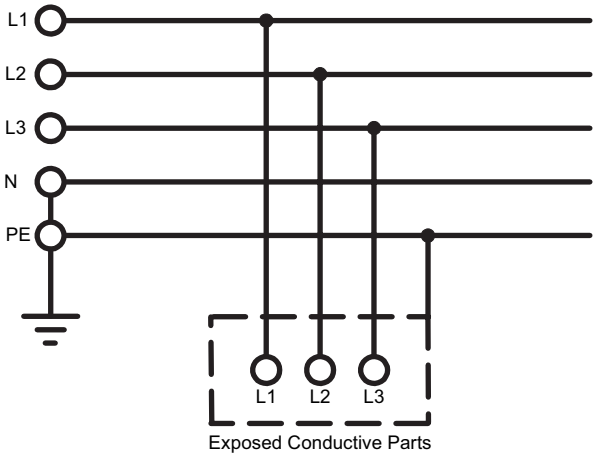


Figure 4-2 TN-S power system

A TN-S power system has separate neutral and protective ground conductors throughout the system.

This type of power system is the standard distribution system in the UK.

TN-C-S Power System

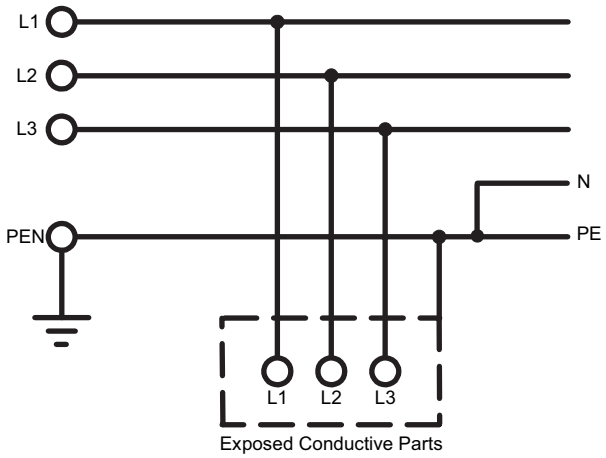


Figure 4-3 TN-C-S power system

In a TN-C-S power system, the neutral and protective functions are combined in a single part of the system.

TN-C Power System

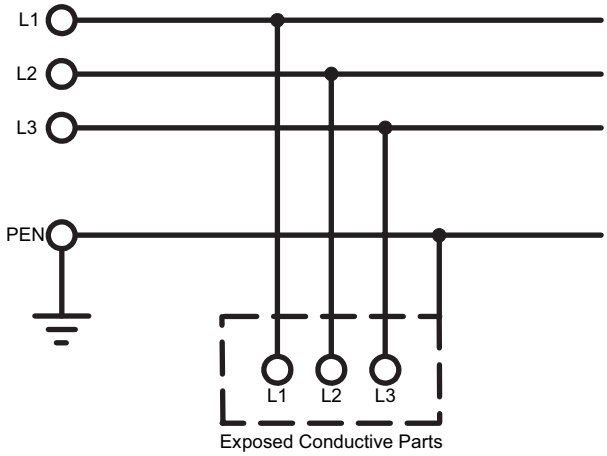


Figure 4-4 TN-C power system

In a TN-C power system, the neutral and protective functions are combined in a single conductor throughout the system.

TT Power System

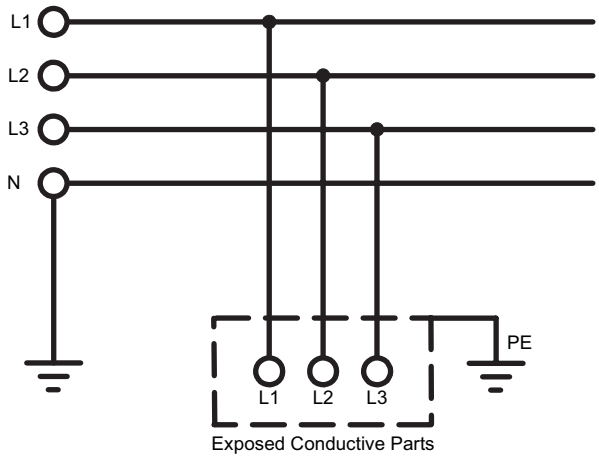


Figure 4-5 TT power system

A TT power system has one point directly grounded, the exposed conductive parts of the installation being connected to a ground, which is electrically independent of the ground of the power system.

IT Power System

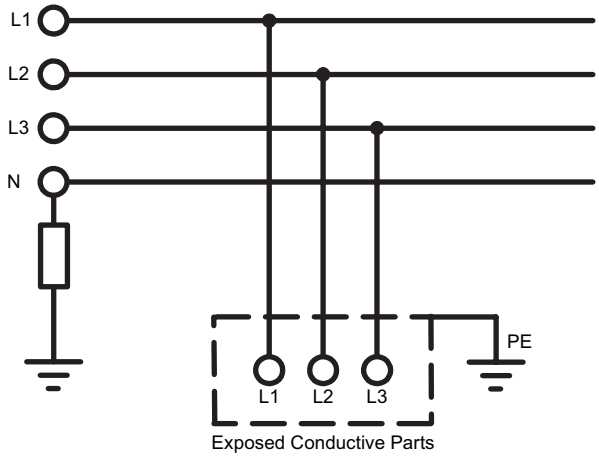


Figure 4-6 IT power system

An IT power system has no direct connection to ground - instead the exposed parts of the electrical installation are grounded.

It will be necessary to provide a mechanism for disconnecting the "DC link midpoint to ground" capacitor.

Note

TT-/IT power systems can only be used with unfiltered drives.

Reforming the capacitors

Following a prolonged period of storage, you must reform the capacitors in the SINAMICS G120 Power Module. The figure below shows the reforming periods required depending upon the period in storage.

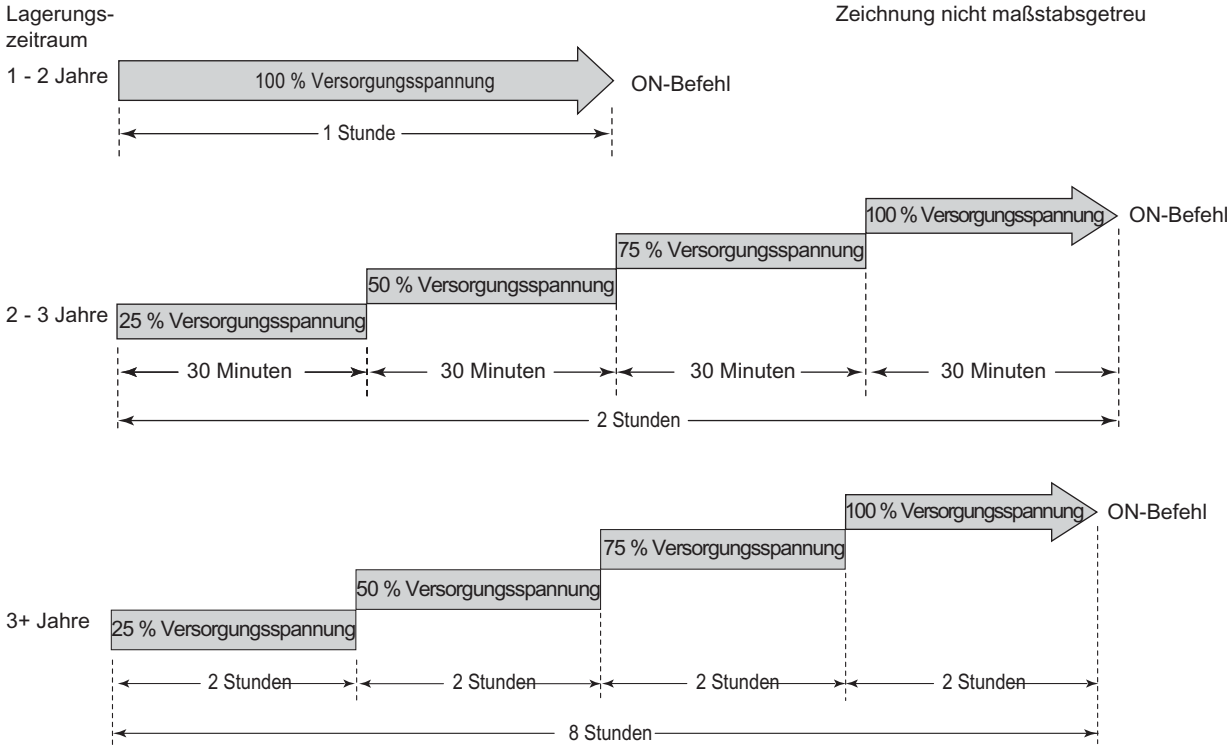


Figure 4-7 Timescale for reforming capacitors

Accessing the power and motor terminals

Frame sizes A … C have no terminal covers.

Frame sizes D … F terminals covers are accessed by releasing the latch on the side of the terminal covers with a suitable flat-bladed screwdriver. The cover can then be pushed upwards and locked into position, as shown in the figure below.

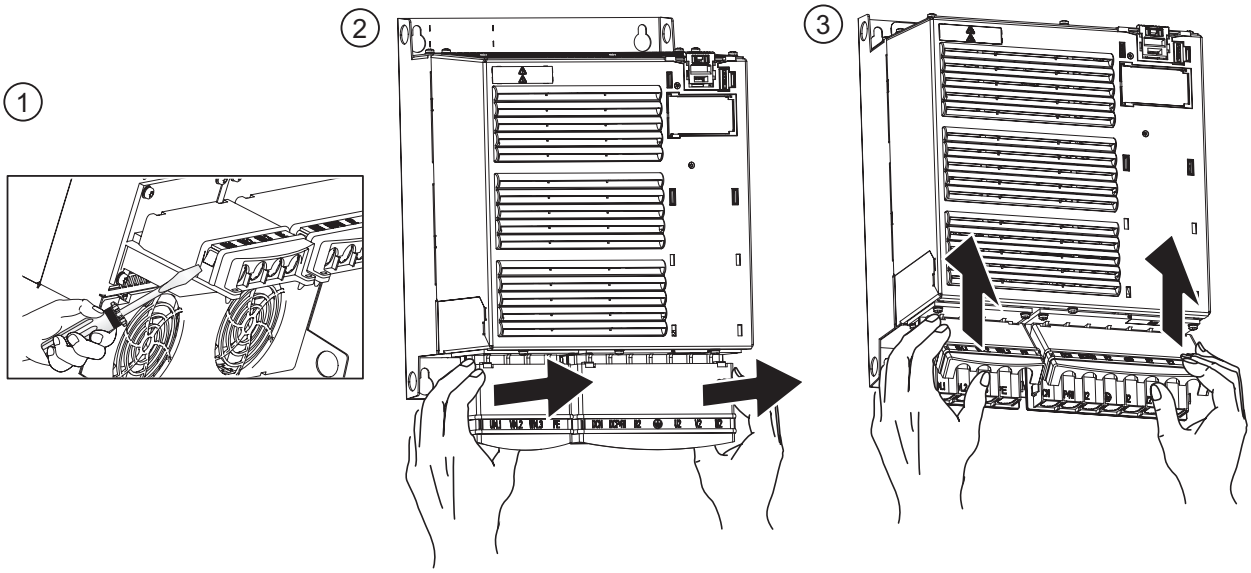
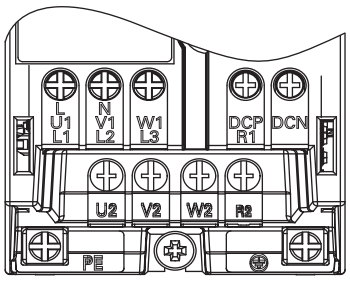


Figure 4-8 Access the power and motor terminals on FSD … FSF

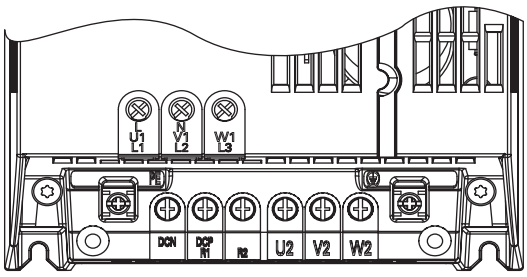
Power and motor terminal layout

Terminals not usually utilised for Frame size A … C are protected by a feature integral to the plastic housing. If access to the terminal is required, the two upper plastic protectors can be removed using a suitable pair of pliers. Ensure that no plastics from the protectors fall into the inverter housing.

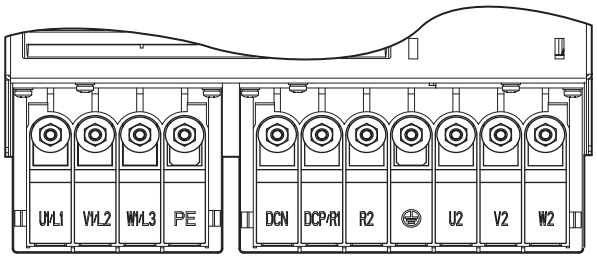
The figure below shows the layout of the power and motor terminals of the PM240 Frame Sizes A … F. The figure also includes the tightening torques for the terminals.



FSA: 1.1 Nm/9.7 lbf.in



FSB: 1.5 Nm/13.27 lbf.in
FSC: 2.25 Nm/19.91 lbf.in



FSD/E: M6: 6 Nm/53 lbf.in
FSF: M8: 13 Nm/115 lbf.in

Figure 4-9 Power and motor terminal layout for the PM240

Line commutating choke (Input choke)

Line commutating chokes are used to smooth voltage peaks (line disturbances) or to bridge commutating dips. In addition, line commutation chokes reduce the effects of harmonics on the SINAMICS G120 power module and on the power supply. If the line impedance is less than 1 % (stiff supply) then a line commutation choke must be used to reduce the current peaks and to protect the SINAMICS G120 power module.

For more information on input chokes, please refer to the product catalog.

Connecting example

The figure below shows the recommended power and motor connections when installing a SINAMICS G120 inverter.

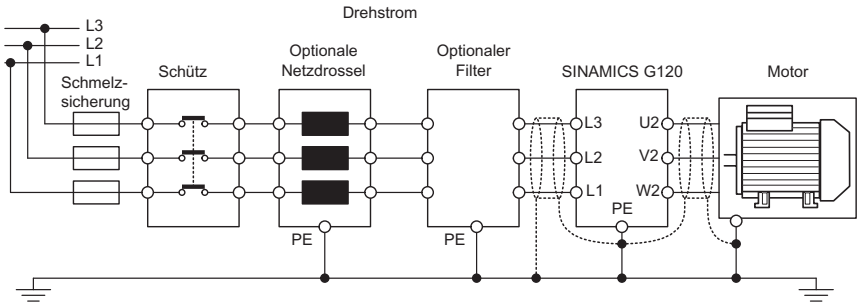


Figure 4-10 Motor and power connections

Operation with ungrounded (IT) supplies

IT supplies are fully isolated from the protective earth system, usually by an isolating transformer. It should be noted, however, that a protective earth is still provided.

Warning

SINAMICS G120 Power Modules with built-in filters or external filters must not be used with IT supplies.

SINAMICS G120 Power Modules connected to IT supplies must have their internal 'Y' capacitors disconnected (see below). If the SINAMICS G120 Power Module connected to an IT supply is required to remain operational if an input or output phase is connected to ground, then an output choke must be fitted to prevent tripping.

Operation of the SINAMICS G120 Power Modules without a protective earth is not permitted under any circumstances.

For more information on chokes, please refer to the product catalog.

Operation with Residual Current Devices (RCD)

If an RCD (also referred to as an ELCB or a RCCB) is fitted, the SINAMICS G120 Power Module will operate without nuisance tripping provided that:

- A type B RCD is used.
- The trip limit of the RCD is 300 mA.
- The neutral of the supply is grounded.
- Only one SINAMICS G120 power module is supplied from each RCD.
- The output cables are less than 50 m (164 ft) screened or 100 m (328 ft) unscreened.

Avoiding Electromagnetic Interference (EMI)

The inverters are designed to operate in an industrial environment where a high level of EMI can be expected. Most installations do not give problems. However, it is good engineering

pratice to conform to the following guidelines - this will reduce the likelihood of problems during operation.

Actions to take

- Ensure that all equipment in the cubicle is well grounded using short, thick grounding cable connected to a common star point or busbar.
- Make sure that any control equipment (such as a PLC) connected to the inverter is connected to the same ground or star point as the inverter using a short thick link.
- Connect the return ground from the motors controlled by the inverters directly to the ground connection (PE) on the associated inverter.
- Flat conductors are preferred as they have lower impedance at higher frequencies.
- Terminate the ends of the cable neatly, ensuring that unscreened wires are as short as possible.
- Separate the control cables from the power cables as much as possible, using separate trunking, if the cables cross they should cross at 90º to each other.
- Whenever possible, use screened leads for the connections to the control circuitry.
- Ensure that the contactors in the cubicle are suppressed, either with R-C suppressors for AC contactors or 'flywheel' diodes for DC contactors fitted to the coils. Varistor suppressors are also effective. This is important when the contactors are controlled from the inverter relay.
- Use screened or armored cables for the motor connections and ground the screen at both ends using the cable clamps.

Warning

Safety regulations must not be compromised when installing inverters!

Screening methods

For all frame sizes the Screen Termination Kit is supplied as an optional extra. It allows easy and efficient connection of the necessary screening. For further details on the Screen Termination Kit, please refer to the SINAMICS G120 catalog.

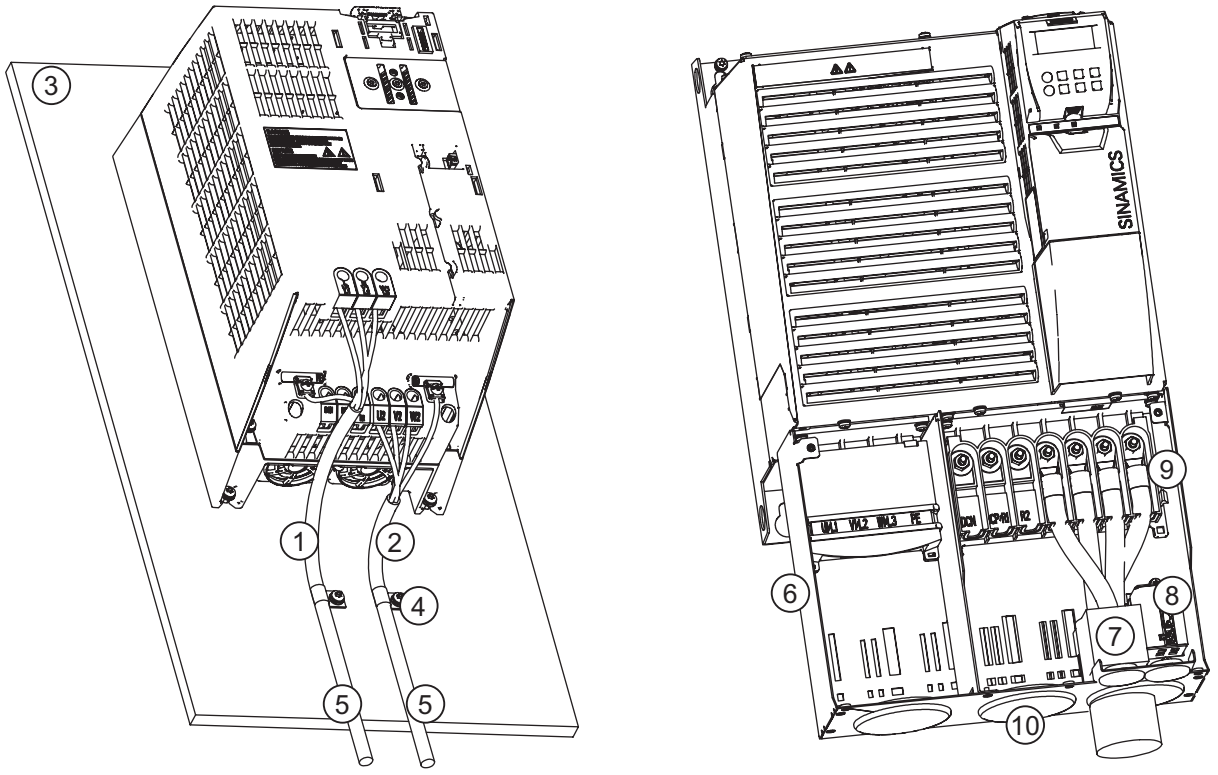
Screening without a Screen Termination Kit

In order to meet radiated emissions a screen termiation kit must be used. Screening without a screen termination kit is only suitable for installation in a metal cabinet.

Should a Screen Termination Kit not be available, then the inverter can be screened using the methodology shown in the figure below. This diagram shows both methodologies of screening.

Note

The EMI illustration below is not to scale. The terminal cover on Frame Size D cannot be removed. It has been removed to show the correct cable connection for the terminals.



Umrichter mit Schirmanschluss-Bausatz

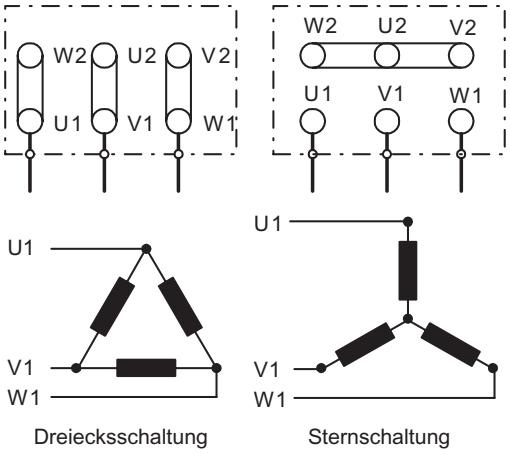
1 Netzeingang
2 Motorleitung
3 Metallrückwand
4 Für die zuverlässige Befestigung der Abschirmung des Motor- und des Netzkabels an der Metallrückwand geeignete Schellen verwenden
5 Geschirmte Kabel
6 Schirmanschluss-Bausatz
7 Kabelschelle
8 Magnetbremsenstecker
9 Kabelschuhe - Kabelabeckung ist nicht abnehmbar - lediglich zu Anschauungszwecken weggelassen
10 Durchführungsdichtungen

Figure 4-11 Example of wiring to minimize the effect of EMI

Motor Circuit

In order to ensure a straightforward, successful commissioning, it is important that the circuit connection in the motor terminal box matches the rated motor voltage entered in P0304 or the rated motor current P0305.

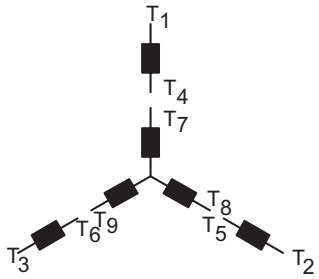
IEC-Motor



Beispiele: Voltzahl 230 V (Dreiecksschaltung) / 400 V (Sternschaltung)

NEMA-Motor

Voltzahl	U	V	W	Aneinander angeschlossen			Anschluss
niedrig	T_1-T_7	T_2-T_8	T_3-T_9	T_4-T_5-T_6			Y Y
hoch	T_1	T_2	T_3	T_1-T_7	T_2-T_8	T_3-T_9	Y



Beispiel: Voltzahl 230 V YY (niedrig) / 460 V Y (hoch)

Voltzahl	U	V	W	Aneinander angeschlossen			Anschluss
niedrig	T_1-T_6-T_7	T_2-T_4-T_8	T_3-T_5-T_9	-			Δ Δ
hoch	T_1	T_2	T_3	T_4-T_7	T_5-T_8	T_6-T_9	Δ

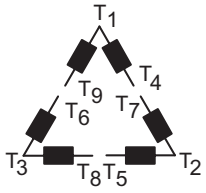
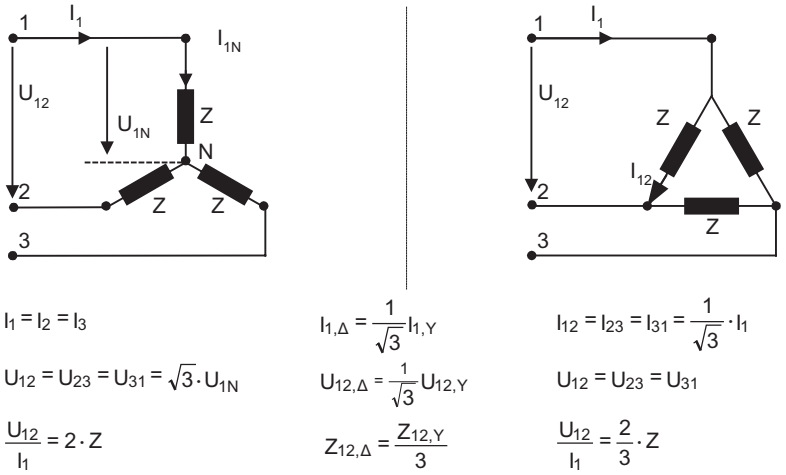


Figure 4-12 Motor terminal box

The following must be noted when entering the rating plate data or the ECD data:

- The outer conductor voltage/phase-to-phase voltage (voltage U12 between outer conductors L1, L2) and the outer conductor current (phase current) I1 are always specified on the rating plate.
- The rated motor voltage and the rated motor current must always be entered according to the motor circuit configuration (either delta/star circuit configuration).
- If rated motor data that are available are not consistent with the motor circuit configuration, then an appropriate conversion should be made which is then entered.
- If equivalent circuit diagram data is available, then these should be entered according to the motor circuit configuration. If there is no consistency between the motor circuit

configuration and equivalent circuit diagram data, then the equivalent circuit diagram data should be converted and entered corresponding to the data on the rating plate.



$I_1 = I_2 = I_3$

$U_{12} = U_{23} = U_{31} = \sqrt{3} \cdot U_{1N}$

$\frac{U_{12}}{I_1} = 2 \cdot Z$

$I_{1,\Delta} = \frac{1}{\sqrt{3}} I_{1,Y}$

$U_{12,\Delta} = \frac{1}{\sqrt{3}} U_{12,Y}$

$Z_{12,\Delta} = \frac{Z_{12,Y}}{3}$

$I_{12} = I_{23} = I_{31} = \frac{1}{\sqrt{3}} \cdot I_1$

$U_{12} = U_{23} = U_{31}$

$\frac{U_{12}}{I_1} = \frac{2}{3} \cdot Z$

Figure 4-13 Star/Delta configuration

Note

The precise equivalent circuit diagram data is of extreme importance regarding the stability of the closed-loop vector control and for the voltage boost applied to the V/f characteristic. Equivalent circuit diagram data can only be estimated from the rating plate data; this is the reason that equivalent circuit diagram data is either determined

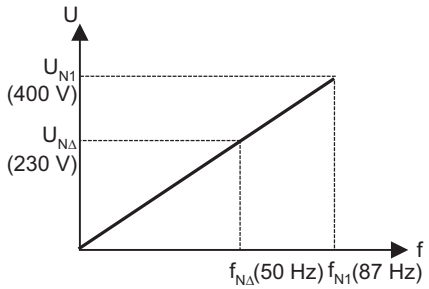
- using the motor data identification, or
- is entered from a motor data sheet that may be available.

87 Hz characteristic

When a motor with a delta circuit configuration (e.g. $V_{N\Delta}$, motor = 230 V) is fed from a frequency inverter, where the rated voltage corresponds to the star circuit configuration (e.g. 400 V frequency inverter), then it is important to proceed as follows and observe the following:

- The motor must have the appropriate voltage strength.
- Above the rated motor frequency, the iron losses in the motor increase over-proportionally. This is the reason that above this frequency, the thermal motor torque should be reduced.
- For the quick commissioning, the rating plate data for the delta circuit configuration should be entered or the rating plate must be appropriately converted.
- The inverter must be designed for the higher current (delta circuit configuration).
- The 87 Hz characteristic is independent of the control type and can therefore be used both for V/f control as well as for closed-loop vector control.
- When using the 87 Hz characteristic, the mechanical motor limits must be taken into account.

For the 87 Hz characteristic, the ratio between the voltage and frequency (V/f characteristic) remain constant. This is the reason that the following relationships apply:



$$P_{N1} = \frac{U_{N1}}{U_{N\Delta}} \cdot P_{N\Delta}$$

$$f_{N1} = \frac{U_{N1}}{U_{N\Delta}} \cdot f_{N\Delta}$$

$$n_{N1} = \frac{60\left[\frac{s}{min}\right]}{p}(f_{N1} - f_{N\Delta}) + n_{\Delta}$$

P = Leistung
f = Frequenz
n = Drehzahl
p = Polpaar-Nr.

Figure 4-14 V/f characteristic

Table 4-3 Example 1LA7060-4AB10

		Delta circuit configuration	87 Hz characteristic	Star circuit configuration
P0304	Rated motor voltage	230 V	400 V	400 V
P0305	Rated motor current	0.73 A	0.73 A	0.42 A
P0307	Rated motor power	120 W	207 W	120 W
P0308	cos φ	0.75	0.75	0.75
P0310	Rated motor frequency	50 Hz	87 Hz	50 Hz
P0311	Rated motor speed	1350 RPM	2460 RPM	1350 RPM
P0314	Motor pole pairs	2	2	2

Contrary to the OP, the STARTER commissioning (start-up) program offers a mask-orientated quick commissioning. On the other hand, the OP offers, in conjunction with the inverter, parameter-orientated quick commissioning.

Fitting the Control Unit to the Power Module

The Control Unit is fitted to the Power Module as shown in the figure below. To disconnect the CU push the release button on top of the PM.

The process of fitting the Control Unit to the Power Module is the same technique no matter which Control Unit or Power Module combination is required.

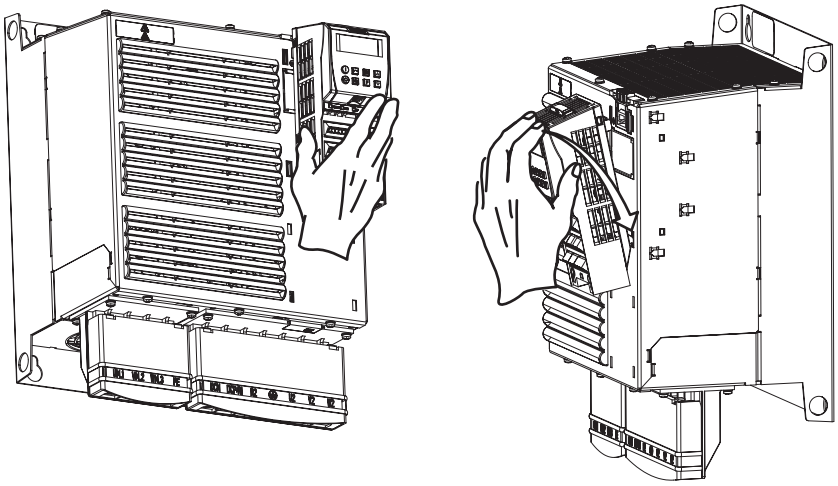


Figure 4-15 Fitting the Control Unit to the Power Module

Caution

Before snap-on the Control Unit to the Power Module while hot swap connect 24 V supply to the terminals.

Operation (hardware) 5

5.1 Installation conditions

General rules for the environmental protection of the SINAMICS G120 Power Modules

To ensure that the SINAMICS G120 Power Module is installed in the correct environmental conditions, please ensure that you adhere to the following guidelines:

- The SINAMICS G120 Power Module is designed for IP20 protection only, this means:
  - It is protected from the ingress of solid foreign objects ≥ 12.5 mm (0.49 inches).
  - It is designed to not allow access to hazardous parts with a finger.
  - It is not protected against the ingress of water.
- Keep the SINAMICS G120 Power Module free from dust and dirt.
- Keep the SINAMICS G120 Power Module away from water, solvents and chemicals.
- Keep the SINAMICS G120 Power Module within the maximum and minimum operating temperatures.
- Ensure that the correct level of ventilation and air flow is provided.
- Ensure that good earthing/grounding practices are followed for each SINAMICS G120 Power Module and the cabinet.

Technical data

6

6.1 Mechanical Data

Distances to other equipment

When mounting the SINAMICS G120 Power Modules one above the other or side by side, the specified environmental conditions must not be exceeded. Independent of this, these minimum distances of the SINAMICS G120 Power Modules must be observed:

Table 6-1 Distances to other equipment

Frame Size	A		B		C		D		E		F	
	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
Side by Side	30	1.18	40	1.57	50	1.96	0	0	0	0	0	0
Above and Below	100	3.93	100	3.93	125	4.92	300	11.81	300	11.81	350	13.77

Ambient operating conditions

Temperature

The normal operating temperature range of the SINAMICS G120 Power Module is as follows:

- 0 °C … + 50 °C (32 °F … 122 °F) High Overload (HO)
- 0 °C … + 40 °C (32 °F … 104 °F) Light Overload (LO).

The ambient operating temperature is shown diagramatically in the figure below.

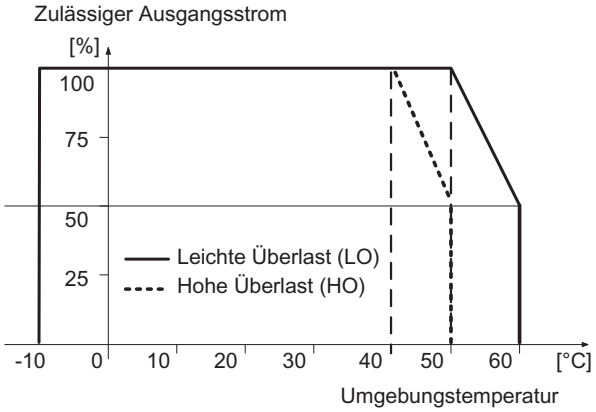


Figure 6-1 Power derating for temperature

Humidity range

Relative air humidity for the SINAMICS G120 Power Module is ≤ 95 % non-condensing.

In areas of high relative humidity, measures should be taken to ensure that condensation does not form within or around the SINAMICS G120 Power Module. Anti-condensation heaters are commonly used to prevent the formation of condensation.

Altitude

If the SINAMICS G120 Power Module is to be installed at an altitude greater than 1000 m (3280 ft) derating will be required. The figure below shows the derating required in accordance with altitude.

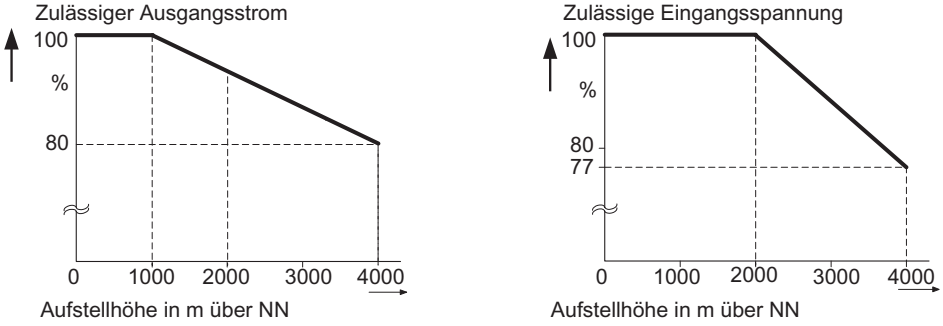


Figure 6-2 Derating for altitude

Shock and vibration

Do not drop the SINAMICS G120 Power Module or expose to sudden shock. Do not install the SINAMICS G120 Power Module in an area where it is likely to be exposed to constant vibration.

Electromagnetic radiation

Do not install the SINAMICS G120 Power Module near sources of electromagnetic radiation.

Atmospheric pollution

Do not install the SINAMICS G120 Power Module in an environment which contains atmospheric pollutants such as dust and/or corrosive gases.

Water

Take care to site the SINAMICS G120 Power Module away from potential water hazards, for example, do not install the SINAMICS G120 Power Module beneath pipes that are subject to condensation. Avoid installing the SINAMICS G120 Power Module where excessive humidity and condensation may occur.

Installation and cooling

Caution

The SINAMICS G120 Power Module MUST NOT be mounted horizontally.

When mounting SINAMICS G120 Power Modules one above the other, the specified environmental conditions and clearance must not be exceeded (see Dimension Drawings)

Independent of this, the minimum distance above and below the SINAMICS G120 Power Modules is 100 mm (3.9 inches).

No equipment that could have a negative effect on the flow of cooling air should be installed in this area. Make sure that the cooling vents in the SINAMICS G120 Power Module are positioned correctly to allow the free movement of air.

Make sure that there is an adequate airflow through the cubicle as follows:

1. Using the formula below, calculate the airflow required:
   Airflow (m^3/hr) = (Dissipated Watts / ΔT) x 3.1
2. If necessary, install cubicle cooling fans.

Note

Dissipation (Watts) = 3 % to 5 % of the SINAMICS G120 Power Module rating.

ΔT = Allowable temperature rise within the cubicle in °C.

3.1 = Specific heat of air at sea level.

Frame Size	A					B			C		
Power Rating	0.37	0.55	0.75	1.1	1.5	2	3	4	5.5	7.5	11
Power Losses	97	99	102	108	114	139	158	183	240	297	396

Dimensions and tightening torques of SINAMICS G120 power modules

The dimensions and tightening torques for securing the inverter are given in the table below.

Table 6-2 Dimensions and tightening torques of SINAMICS G120 power modules

Frame size	Dimensions	Height x Width x Depth (H x W x D)		Fixing method	Tightening torques
		(with CU)	(without CU)		
A	mm	173 x 73 x 210	173 x 73 x 145	2 x M4 bolts, 2 x M4 nuts, 2 x M4 washers	2.5 Nm (22.1 lbf.in) with washers fitted.
	inch	6.81 x 2.87 x 8.27	6.81 x 2.87 x 5.71		
B	mm	270 x 153 x 230	270 x 153 x 165	4 x M4 bolts, 4 x M4 nuts, 4 x M4 washers	
	inch	10.63 x 6.02 x 9.05	10.63 x 6.02 x 6.50		
C	mm	334 x 189 x 250	334 x 189 x 185	4 x M5 bolts, 4 x M5 nuts, 4 x M5 washers	
	inch	13.1 x 7.41 x 9.84	13.1 x 7.41 x 7.28		
D Unfiltered	mm	419 x 275 x 260	419 x 275 x 204	4 x M6 bolts, 4 x M6 nuts, 4 x M6 washers	6 Nm (53 lbf.in) with washers fitted.
	inch	16.3 x 10.8 x 10.2	16.3 x 10.8 x 8.0		
D Filtered	mm	512 x 275 x 260	512 x 275 x 204		
	inch	20.1 x 10.8 x 10.2	20.1 x 10.8 x 8.0		
E Unfiltered	mm	499 x 275 x 260	499 x 275 x 204		
	inch	19.6 x 10.8 x 10.2	19.6 x 10.8 x 8.0		
E Filtered	mm	635 x 275 x 260	635 x 275 x 204		
	inch	25.0 x 10.8 x 10.2	25.0 x 10.8 x 8.0		
F Unfiltered	mm	635 x 350 x 372	635 x 350 x 316	4 x M8 bolts, 4 x M8 nuts, 4 x M8 washers	13 Nm (115 lbf.in) with washers fitted.
	inch	25.0 x 13.8 x 14.6	25.0 x 13.8 x 12.4		
F Filtered	mm	934 x 350 x 372	934 x 350 x 316		
	inch	36.8 x 13.8 x 14.6	36.8 x 13.8 x 12.4		

6.2 Electrical Data

Power and motor connections

Warning

The SINAMICS G120 inverter must always be grounded.

Isolate the line supply before making or changing connections to the unit.

Ensure that the SINAMICS G120 inverter is configured for the correct supply voltage. The SINAMICS G120 inverter must not be connected to a higher voltage supply.

When synchronous motors are connected or when coupling several motors in parallel, the SINAMICS G120 inverter must be operated with V/f control characteristics (P1300 = 0, 2 or 3).

Caution

The control, power supply and motor cables must be laid separately. Do not feed them through the same cable conduit or trunking.

After connecting the power and motor cables to the proper terminals, make sure that the front covers (FSD to FSF only) have been returned to the closed position and are snapped shut, before supplying power to the SINAMICS G120 inverter!

Notice

Ensure that the appropriate circuit-breakers/fuses with the specified current rating are connected between the power supply and the SINAMICS G120 inverter (see Technical data).

Use Class 1 75 °C copper wire only (for UL compliance).

For tightening torques, see Technical data.

Air cooling requirements

Table 6-3 Air cooling requirements

Frame size	Required cooling air flow	
	l/s	CFM
A	4.8	10.2
B	24.0	51.0
C	54.9	116.3
D	54.9	116.3
E	2 x 54.9	2 x 116.3
F	150.0	317.79

Relationship between pulse frequency and current reduction

Table 6-4 Current reduction depending on pulse frequency

Power rating at 400 V	Frame size	Inverter current rating	Output current at pulse frequency of					
		at 4 kHz	6 kHz	8 kHz	10 kHz	12 kHz	14 kHz	16 kHz
kW		A	A	A	A	A	A	A
0.37	A	1.3	1.1	0.9	0.8	0.7	0.6	0.5
0.55	A	1.7	1.4	1.2	1.0	0.9	0.8	0.7
0.75	A	2.2	1.9	1.5	1.3	1.1	1.0	0.9
1.1	A	3.1	2.6	2.2	1.9	1.6	1.4	1.2
1.5	A	4.1	3.5	2.9	2.5	2.1	1.8	1.6
2.2	B	5.9	5.0	4.1	3.5	3.0	2.7	2.4
3	B	7.7	6.5	5.4	4.6	3.9	3.5	3.1
4	B	10.2	8.7	7.1	6.1	5.1	4.6	4.1
5.5	C	13.2	11.2	9.2	7.9	6.6	5.9	5.3
7.5	C	19	16.2	13.3	11.4	9.5	8.6	7.6
11	C	26	22.1	18.2	15.6	13.0	11.7	10.4
15	D	32	27.2	22.4	19.2	16.0	14.4	12.8
18.5	D	38	32.3	26.6	22.8	19.0	17.1	15.2
22	D	45	38.3	31.5	27.0	22.5	20.3	18.0
30	E	62	52.7	43.4	37.2	31.0	27.9	24.8
37	E	75	63.8	52.5	45.0	37.5	33.8	30.0
45	F	90	76.5	63.0	54.0	45.0	40.5	36.0
55	F	110	93.5	77.0	66.0	55.0	49.5	44.0
75	F	145	123.3	101.5	87.0	72.5	65.3	58.0

Braking resistor data

Table 6-5 Data for braking resistors

Rated Voltage	V_{DC_max}	I_{DC_max} for Frame size					
		A	B	C	D	E	F
400 V	820 V … 840 V	2.15 A (390 Ω)	5.25 A (160 Ω)	15 A (56 Ω)	30.4 A (27 Ω)	54.7 A (15 Ω)	100.0 A (8.2 Ω)

Power Module PM240 Specifications

Caution

High Overload (HO) and Light Overload (LO) input currents

The input current at the rated operating point - applies for the short-circuit voltage of the line supply V_k = 1 % referred to the rated SINAMICS G120 Power Module power and a rated line supply voltage of 400 V without line a commutating reactor. If a line commutating reactor is used, the specified values are reduced by between 70 % and 80 %.

Notice

UL certified Fuses must be used

In order that the system is in compliance with UL, UL certified fuses, circiut-breaker or self protected combination motorcontroller must be used.

Table 6-6 Rated Output, Input and Fuses

Product	Power Module 400 V	Frame size	rated output		HO		LO		fuse	
					rated output current	rated input current	rated output current	rated input current		3NA3…/ 3NE1…
6SL3224-…	A		kW	hp	A	A	A	A	A	Type
unfiltered										
0BE13-7UA0	1.3	A	0.37	0.5	1.3	1.6	1.3	1.7	10	803/ -
0BE15-5UA0	1.7	A	0.55	0.75	1.7	2.0	1.7	2.1	10	803/ -
0BE17-5UA0	2.2	A	0.75	1	2.2	2.5	2.2	2.6	10	803/ -
0BE21-1UA0	3.1	A	1.1	1.5	3.1	3.8	3.1	3.9	10	803/ -
0BE21-5UA0	4.1	A	1.5	1	4.1	4.8	4.1	4.9	10	803/ -
0BE22-2UA0	5.9	B	2.2	3	5.9	7.6	5.9	7.6	16	805/ -
0BE23-0UA0	7.7	B	3	4	7.7	10.2	7.7	10.2	16	805/ -
0BE24-0UA0	10	B	4	5	10.2	13.4	10.2	13.4	20	807/ -
0BE25-5UA0	18	C	5.5	7.5	13.2	16.7	18	21.9	20	807/ -
0BE27-5UA0	25	C	7.5	10	19	23.7	25	31.5	32	807/ -
0BE31-1UA0	32	C	11	15	26	32.7	32	39.4	35	812/ -
0BE31-5UA0	38	D	15	20	32	40	38	46	50	820/ 817-0*
0BE31-8UA0	45	D	18.5	25	38	46	45	53	63	822/ 818-0*
0BE32-2UA0	60	D	22	30	45	56	60	72	80	824/ 820-0*
0BE33-0UA0	75	E	30	40	60	73	75	88	100	830/ 021-0*
0BE33-7UA0	90	E	37	50	75	90	90	105	125	832/ 022-0*
0BE34-5UA0	110	F	45	60	90	108	110	129	160	836/ 224-0*
0BE35-5UA0	145	F	55	75	110	132	145	168	200	140/ 225-0*
0BE37-5UA0	178	F	75	100	145	169	178	204	250	144/ 227-0*

Table 6-7 Rated Output, Input and Fuses

Product	Power Module 400 V	Frame size	rated output		HO		LO		fuse	
					rated output current	rated input current	rated output current	rated input current		3NA3…/ 3NE1…
6SL3224-…	A		kW	hp	A	A	A	A	A	Type
with filter class A										
0BE22-2AA0	5.9	B	2.2	3	5.9	7.6	5.9	7.6	16	805/ -
0BE23-0AA0	7.7	B	3	4	7.7	10.2	7.7	10.2	16	805/ -
0BE24-0AA0	10	B	4	5	10.2	13.4	10.2	13.4	20	807/ -
0BE25-5AA0	18	C	5.5	7.5	13.2	16.7	18	21.9	20	807/ -
0BE27-5AA0	25	C	7.5	10	19	23.7	25	31.5	32	812/ -
0BE31-1AA0	32	C	11	15	26	32.7	32	39.4	35	814/ -
0BE31-5AA0	38	D	15	20	32	40	38	46	50	820/ 817-0*
0BE31-8AA0	45	D	18.5	25	38	46	45	53	63	822/ 818-0*
0BE32-2AA0	60	D	22	30	45	56	60	72	80	824/ 820-0*
0BE33-0AA0	75	E	30	40	60	73	75	88	100	830/ 021-0*
0BE33-7AA0	90	E	37	50	75	90	90	105	125	832/ 022-0*
0BE34-5AA0	110	F	45	60	90	108	110	129	160	836/ 224-0*
0BE35-5AA0	145	F	55	75	110	132	145	168	200	140/ 225-0*
0BE37-5AA0	178	F	75	100	145	169	178	204	250	144/ 227-0*

Table 6-8 Input, Output Cable and Weight

Product	Power Module 400 V	Frame size	Input cable				Output cable				weight	
			min.	max.	min.	max.	min.	max.	min.	max.		
6SL3224-...	A		mm^2	mm^2	awg	awg	mm^2	mm^2	awg	awg	kg	lbs
unfiltered												
0BE13-7UA0	1.3	A	1.0	2.5	18	14	1.0	2.5	18	14	1.2	2.6
0BE15-5UA0	1.7	A	1.0	2.5	18	14	1.0	2.5	18	14	1.2	2.6
0BE17-5UA0	2.2	A	1.0	2.5	18	14	1.0	2.5	18	14	1.2	2.6
0BE21-1UA0	3.1	A	1.0	2.5	18	14	1.0	2.5	18	14	1.2	2.6
0BE21-5UA0	4.1	A	1.0	2.5	18	14	1.0	2.5	18	14	1.2	2.6
0BE22-2UA0	5.9	B	1.5	6.0	16	10	1.0	6.0	18	10	4.3	9.5
0BE23-0UA0	7.7	B	1.5	6.0	16	10	1.0	6.0	18	10	4.3	9.5
0BE24-0UA0	10	B	2.5	6.0	14	10	1.0	6.0	18	10	4.3	9.5
0BE25-5UA0	18	C	4.0	10.0	12	8	4.0	10.0	12	8	6.5	14.3
0BE27-5UA0	25	C	4.0	10.0	12	8	4.0	10.0	12	8	6.5	14.3
0BE31-1UA0	32	C	6.0	10.0	10	8	6.0	10.0	10	8	6.5	14.3
0BE31-5UA0	38	D	10.0	35.0	7	2	10.0	35.0	7	2	15.9	35.1
0BE31-8UA0	45	D	10.0	35.0	7	2	10.0	35.0	7	2	15.9	35.1
0BE32-2UA0	60	D	16.0	35.0	5	2	16.0	35.0	5	2	15.9	35.1
0BE33-0UA0	75	E	25.0	35.0	3	2	25.0	35.0	3	2	19.8	43.7
0BE33-7UA0	90	E	25.0	35.0	3	2	25.0	35.0	3	2	19.8	43.7
0BE34-5UA0	110	F	35.0	120.0	2	4/0	35.0	120.0	2	4/0	50.7	111.8
0BE35-5UA0	145	F	70.0	120.0	2/0	4/0	70.0	120.0	2/0	4/0	50.7	111.8
0BE37-5UA0	178	F	95.0	120.0	3/0	4/0	95.0	120.0	3/0	4/0	50.7	111.8

Table 6-9 Input, Output Cable and Weight

Product	Power Module 400 V	Frame size	Input cable				Output cable				weight	
			min.	max.	min.	max.	min.	max.	min.	max.		
6SL3224-…	A		mm²	mm²	awg	awg	mm²	mm²	awg	awg	kg	lbs
with filter class A												
0BE22-2AA0	5.9	B	1.5	6.0	16	10	1.0	6.0	18	10	4.3	9.5
0BE23-0AA0	7.7	B	1.5	6.0	16	10	1.0	6.0	18	10	4.3	9.5
0BE24-0AA0	10	B	2.5	6.0	14	10	1.0	6.0	18	10	4.3	9.5
0BE25-5AA0	18	C	2.5	10.0	14	8	2.5	10.0	14	8	6.5	14.3
0BE27-5AA0	25	C	4.0	10.0	12	8	4.0	10.0	12	8	6.5	14.3
0BE31-1AA0	32	C	6.0	10.0	10	8	6.0	10.0	10	8	6.5	14.3
0BE31-5AA0	38	D	10.0	35.0	7	2	10.0	35.0	7	2	19.3	42.5
0BE31-8AA0	45	D	10.0	35.0	7	2	10.0	35.0	7	2	19.3	42.5
0BE32-2AA0	60	D	16.0	35.0	5	2	16.0	35.0	5	2	19.3	42.5
0BE33-0AA0	75	E	25.0	50.0	3	1/0	25.0	35.0	3	2	27.1	59.7
0BE33-7AA0	90	E	25.0	50.0	3	1/0	25.0	35.0	3	2	27.1	59.7
0BE34-5AA0	110	F	35.0	120.0	2	4/0	50.0	120.0	1/0	4/0	66.7	147.0
0BE35-5AA0	145	F	70.0	120.0	2/0	4/0	70.0	120.0	2/0	4/0	66.7	147.0
0BE37-5AA0	178	F	95.0	120.0	3/0	4/0	95.0	120.0	3/0	4/0	66.7	147.0

SINAMICS G120 Power Module

Table 6-10 Performance ratings

Feature	Specification
Line operating voltage & power ranges	3 AC 380 V … 480 V ± 10 %
	High Overload: 0.37 kW … 75 kW (0.50 hp … 100.0 hp)
	Light Overload: 2.2 kW … 75 kW (3.0 hp … 100.0 hp)
Input frequency	47 Hz … 63 Hz
Output frequency	0 Hz … 650 Hz
cos φ	0.95
Inverter efficiency	95 % … 97 %
Overload capability (HO)	1.5 x Nominal output current (150 % overload) for 57 s every 300 s
	2 x Nominal output current (200 % overload) for 3 s every 300 s
Overload capability (LO)	1.1 x Nominal output current (110 % overload) for 57 s every 300 s
	1.5 x Nominal output current (150 % overload) for 3 s every 300 s
Inrush current	Less than rated input current
Pulse frequency	4 kHz (standard); 4 kHz … 16 kHz (in 2 kHz steps)
Electromagnetic compatibility	Optional Class A filters available according to EN 55011
Braking	DC braking, Compound braking, Dynamic braking with integrated chopper (braking functionality depends on the type of CU and PM)
Protection level	IP20
Temperature range	0 °C … +50 °C (32 °F … 122 °F) - High Overload (HO)
	0 °C … +40 °C (32 °F … 104 °F) - Light Overload (LO)
Storage temperature	-40 °C … +70 °C (-40 °F … 158 °F)
Humidity	< 95% RH - non-condensing
Operational altitude	Up to 1000 m (3280 ft) above sea level without derating
Protection features	Undervoltage, Overvoltage, Overload, Ground faults, Short circuit, Stall prevention, Motor blocking protection, Motor overtemperature, Power Module overtemperature, Parameter interlock
Standards	UL, cUL, CE, C-tick
CE marked	Conformity with EC Low Voltage Directive 73/23/EEC and filtered versions also Electromagnetic Compatibility Directive 89/336/EEC

Permissable Cable Length

All inverters will operate at full specification with cable lengths as follows:

- Screened 25 m (82 ft) for filtered drives
  50 m (164 ft) for unfiltered drives
- Unscreened 100 m (328 ft) for both filtered and unfiltered drives

Using output chokes as specified in the SINAMICS G120 catalog, the following cable lengths are possible:

Frame size	Max. permissable motor cable length for line voltage of			
	380 V … 400 V ± 10 %		400 V … 480 V ± 10 %	
	shielded	unshielded	shielded	unshielded
A	150 m	150 m	100 m	100 m
B … C	150 m	225 m	100 m	150 m
D … F	200 m	300 m	200 m	300 m

Tightening torques for power terminals

Table 6-11 Power terminals - tightening torques

Frame size	Tightening Torques	
	Nm	lbf.in
A	1.1	9.7
B	1.5	13.27
C	2.25	19.91
D	6	53
E	6	53
F	13	115

Dimension drawings

7

7.1 Dimensions of the PM240

Power Module PM240 Dimension Drawings

The dimension drawings for all frame sizes for the SINAMICS G120 Power Module PM240 are shown in the figures below.

In combination with CU and other options please add following dimensions:

Table 7-1 Additional dimensions

Frame size	PM height + …		PM depth + …	
	mm	inch	mm	inch
Control Unit				
all sizes	--	--	65	2.56
Screen termination kit w/o brake module				
FSA	98	3.86	--	--
FSB	90	3.54	--	--
FSC	98	3.50	--	--
FSD	122	4.78	122	4.78
FSE	122	4.78	122	4.78
FSF	149	5.84	149	5.84
NEMA kit with top hat				
FSA	159	6.25	65	2.56
FSB	165	6.49	65	2.56
FSC	167	6.57	65	2.56
FSD	200	7.84	54	2.12
FSE	200	7.84	54	2.12
FSF	264	10.4	54	2.12

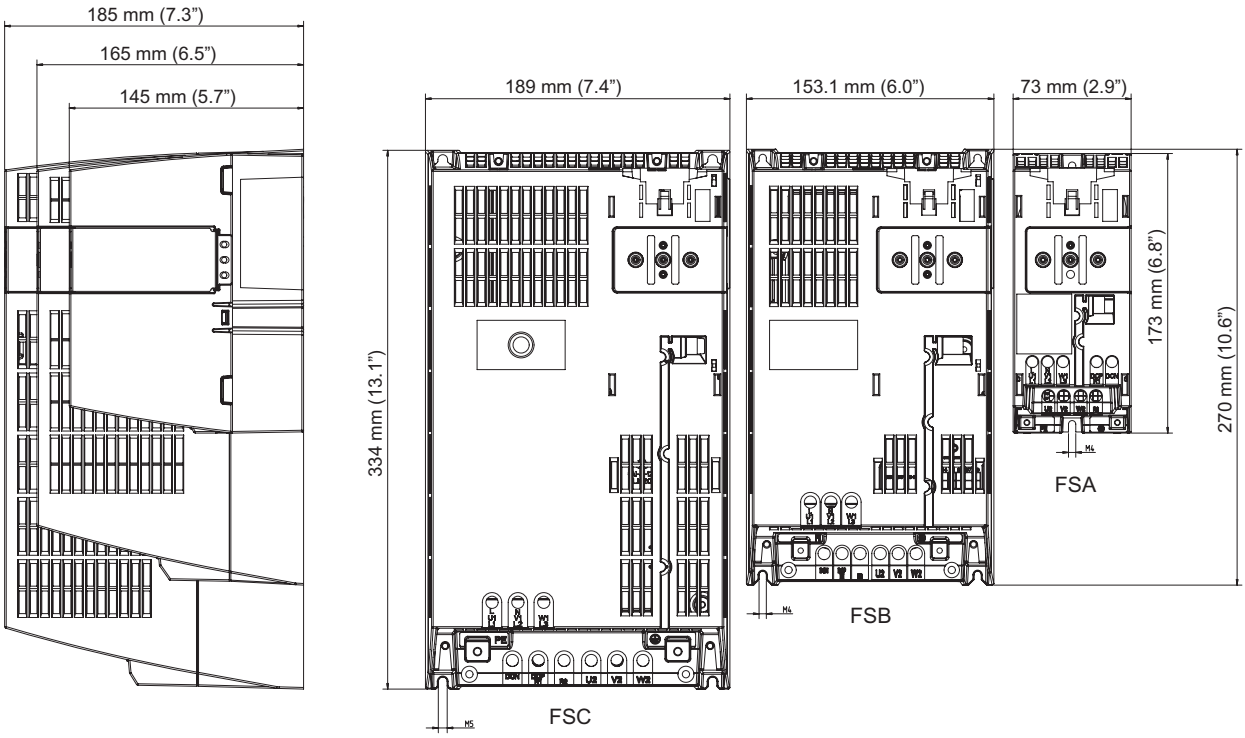


Figure 7-1 FSA … FSC Dimensions

SINAMICS G120 Baugröße D mit Filter

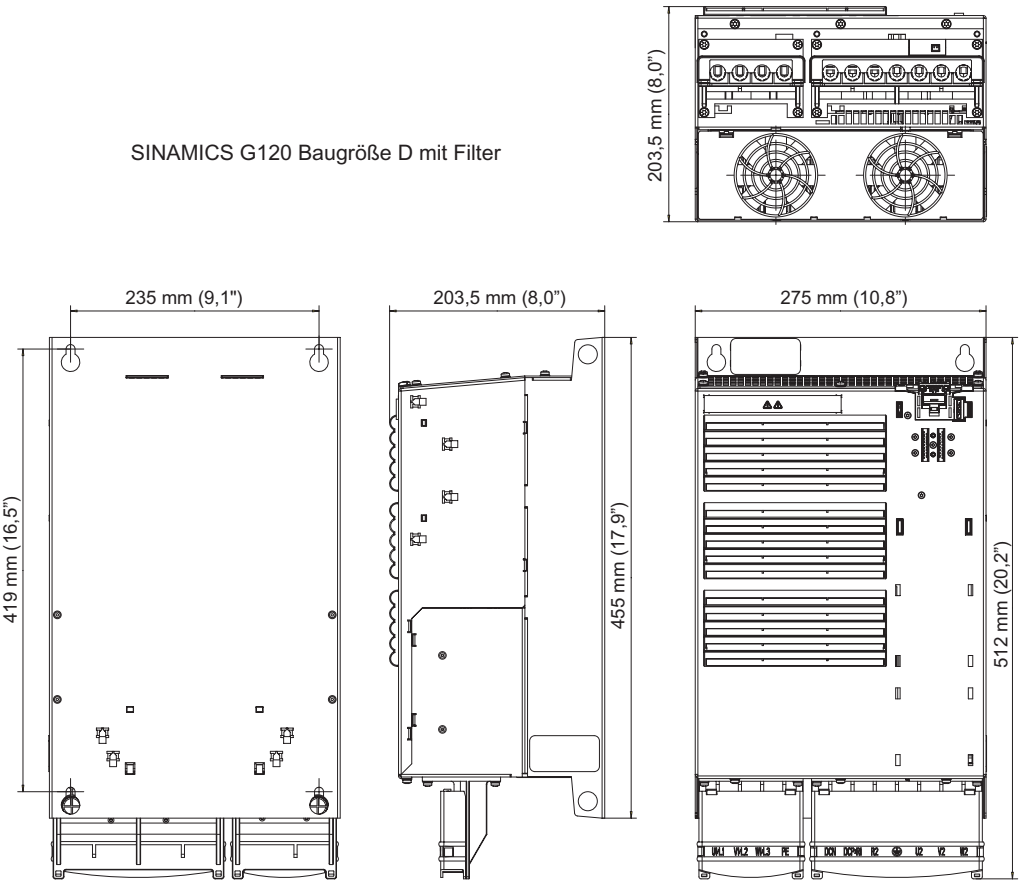
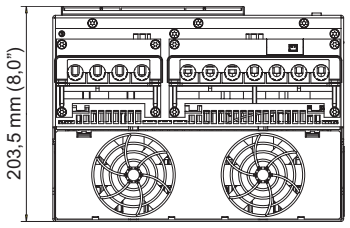


Figure 7-2 Frame size D (filtered) dimensions

SINAMICS G120 FSD ohne Filter



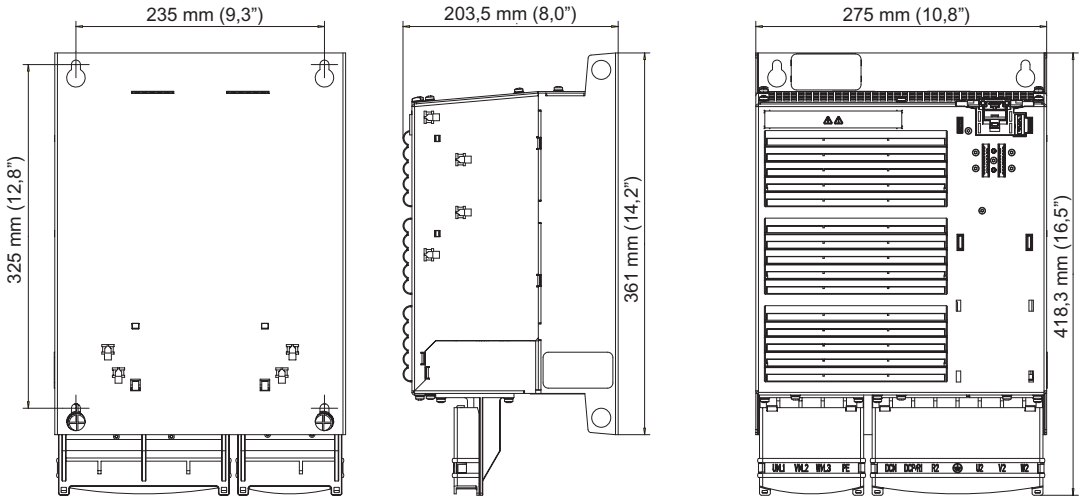


Figure 7-3 Frame size D (unfiltered) dimensions

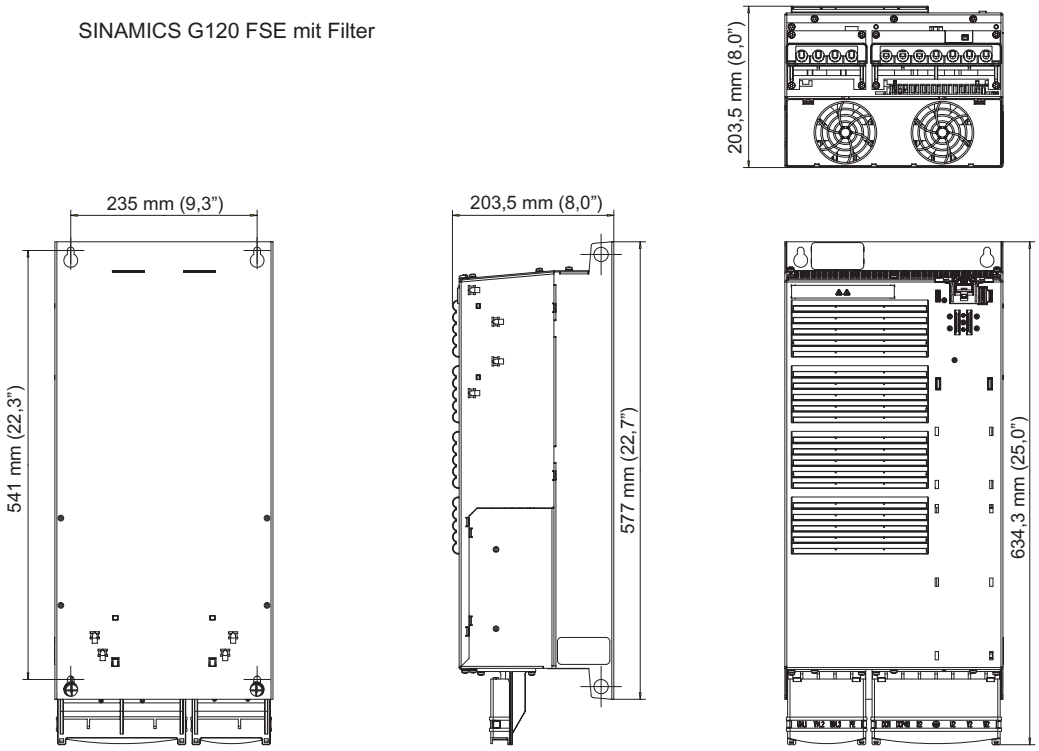
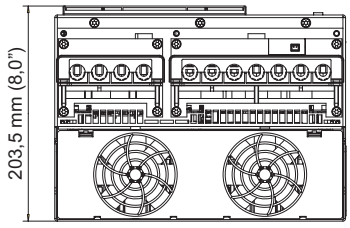


Figure 7-4 Frame size E (filtered) dimensions

SINAMICS G120 FSE ohne Filter



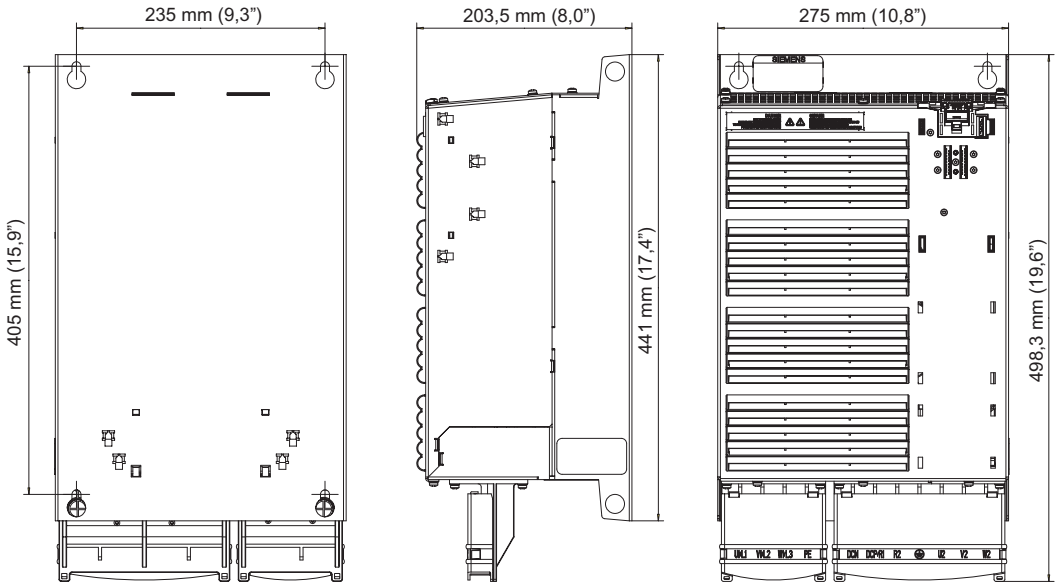


Figure 7-5 Frame size E (unfiltered) dimensions

SINAMICS G120 FSF mit Filter

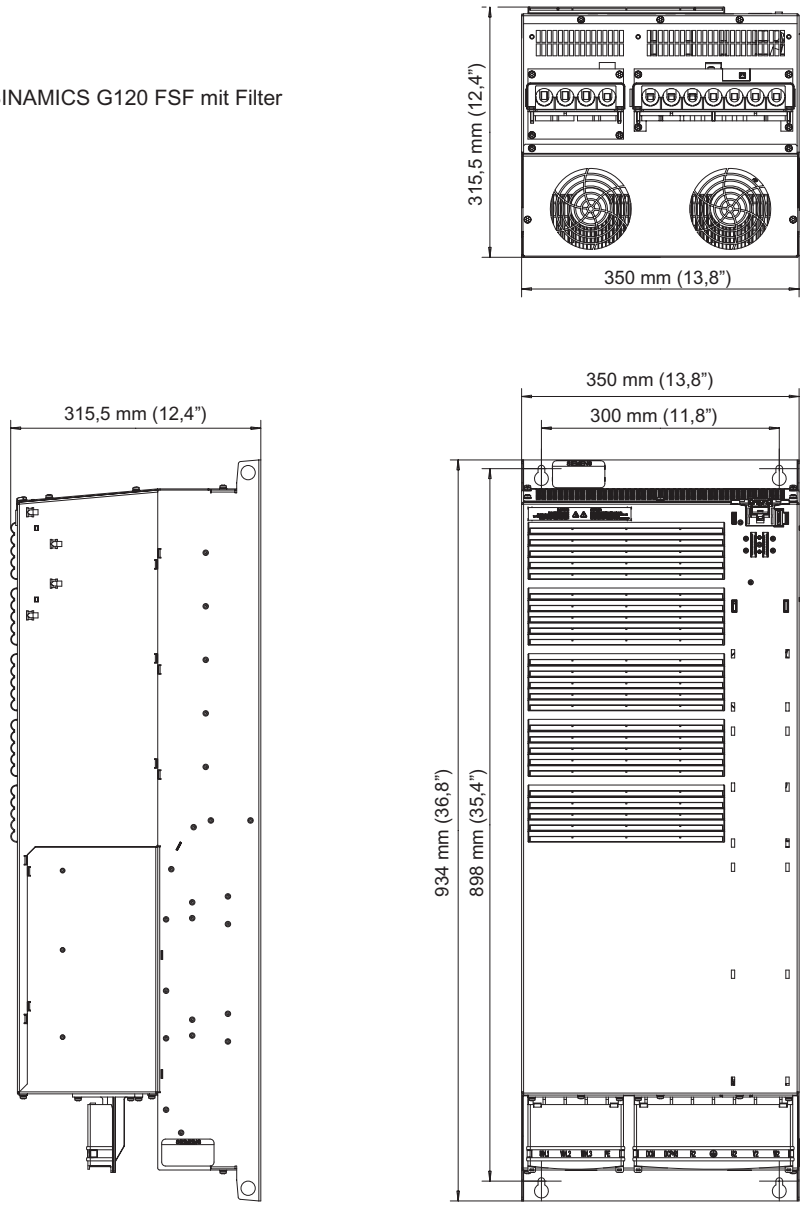


Figure 7-6 Frame size F (filtered) dimensions

SINAMICS G120 FSF ohne Filter

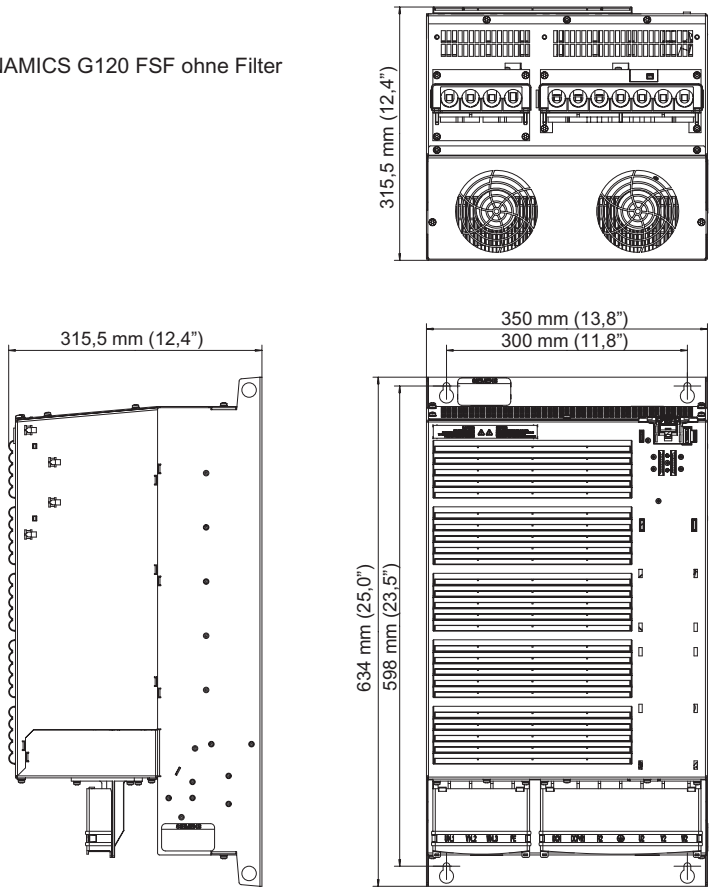


Figure 7-7 Frame size F (unfiltered) dimensions

Spare parts/Accessories

8

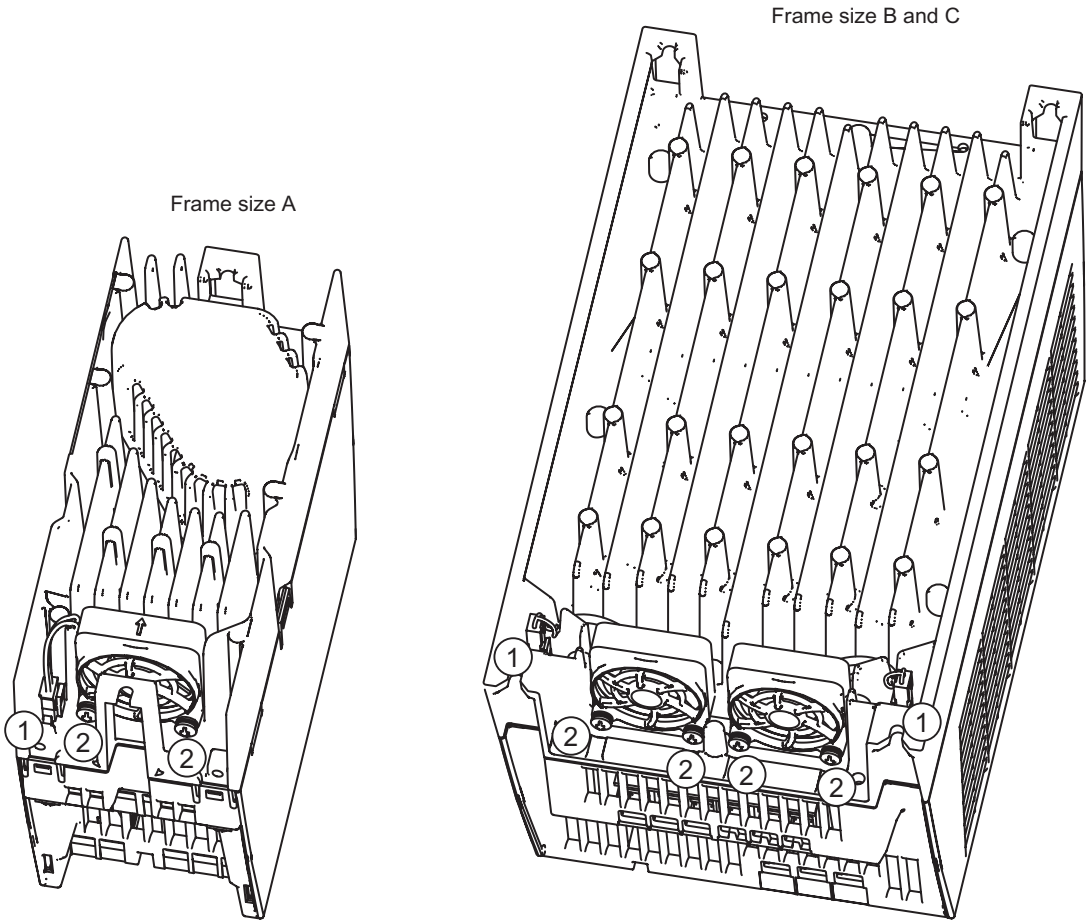
8.1 Replacing a Cooling Fan

Replacing a Cooling Fan

Frame sizes A, B and C have been designed to allow the cooling fans to be replaced. Although the various frame sizes differ in physical size and the number of fans, the replacement procedure is similar. Frame size A contains one fan and frame size B and C contain two fans. The Control Unit must be removed from the Power Module. Power-down the Power Module and disconnect all cables. The Power Module must be placed face-down on a clean and safe surface and the cooling fan removed by releasing the power connection and the retaining screws. The new cooling fan is fitted in reverse order.

To replace the cooling fan on the SINAMIC G120 Power Modules for FSA, FSB and FSC, the following procedure should be performed. Please refer the Figure below.

1. Power-down the inverter.
2. Remove the Control Unit from the inverter.
3. Disconnect all the cables from the Power Module.
4. Release the fan cable connector(s) ①.
5. Using a posi-drive screwdriver, remove the fan retaining screws ②.
6. Slide the cooling fan out from the inverter.
7. Fit the new cooling fan into the fan housing area.
8. Secure the replacement cooling fan in place by tighten the retaining screws ②.
9. Re-attach the fan cable connector(s) ①.
10. Mount the Power Module.
11. Reconnect all the necessary cables to the Power Module.
12. Reattach the Control Unit.
13. Check that the installation is correct and safely installed.
14. Apply power the system.
15. Check that the cooling fan(s) are running correctly.



1 - Fan connector
2 - Retaining screws

Figure 8-1 Replacing the cooling fan

8.2 Power Module accessories

DIN rail mounting kit

The DIN rail mounting kit (DRMK) is designed to allow the SINAMICS G120 Frame Size A and B (FSA and B) inverters to be mounted on a pair of parallel DIN rails.

The DRMK provides an integrated screening plate to allow for the termination of the screened motor cables and other screened cable used with the inverter.

The DRMK for FSA allows for the mounting of either the inverter as a stand-alone or with the inverter and the footprint filter. The FSB inverters, due to their physical size and weight can only be mounted as stand-alone inverters.

The EM brake or safe brake module can only be mounted on the FSA or FSB DIN rail when used in conjunction with the relevant screen termination kit, see table below.

The required DIN rail pitch for each frame size are given in the table below.

Table 8-1 DIN rail pitch

Frame size	DIN rail pitch (mm)
FSA	115 (± 1)
FSB	115 (± 1)

Ordering information is given in the following table:

Table 8-2 DIN rail mounting kit ordering information

Description	Order No.
G120/S120 FSA DIN Rail Kit	6SL3262-1BA00-0BA0
G120/S120 FSB DIN Rail Kit	6SL3262-1BB00-0BA0

NEMA 1 kit

The NEMA 1 kit has been designed to provide some protection against limited amounts of falling dirt in an indoor environment. The level of protection does not protect against falling liquids.

The NEMA 1 kit only provides protection for the inverter itself and does not protect any of the footprint options or the DIN rail kit.

The kit provides protection for both the power module and the control unit including easy access to the MMC on the control unit.

The NEMA 1 kit consists of the following components:

- Top cover (to protect the top of the inverter).
- Metal glanding box (to allow the correct termination of control cables).
- Gland box cover (to ensure that the control cables can not be touched accidentally).

Ordering information is given in the following table:

Table 8-3 NEMA 1 kit ordering information

Description	Order No.
G120/S120 FSA NEMA 1 Kit	6SL3262-1CA00-0BA0
G120/S120 FSB NEMA 1 Kit	6SL3262-1CB00-0DA0
G120/S120 FSC NEMA 1 Kit	6SL3262-1CC00-0DA0
G120/S120 FSD NEMA 1 Kit	6SL3262-1CD00-0DA0
G120/S120 FSE NEMA 1 Kit	6SL3262-1CE00-0DA0
G120/S120 FSF NEMA 1 Kit	6SL3262-1CF00-0DA0

Screen termination kit

The screen termination kit has been designed to allow the termination of control, mains and power cables to ensure the correct electrical grounding to the inverter.

For FSA the screen termination kit provides for the termination of 3 screened cables.

For FSB and larger the screen termination kits provides for the termination of at least 4 screened cables.

Ordering information is given in the following table:

Table 8-4 Screen termination kit ordering information

Description	Order No.
G120/S120 FSA Screen Termination Kit	6SL3262-1AA00-0BA0
G120/S120 FSB Screen Termination Kit	6SL3262-1AB00-0DA0
G120/S120 FSC Screen Termination Kit	6SL3262-1AC00-0DA0
G120/S120 FSD Screen Termination Kit	6SL3262-1AD00-0DA0
G120/S120 FSE Screen Termination Kit	6SL3262-1AD00-0DA1
G120/S120 FSF Screen Termination Kit	6SL3262-1AF00-0DA0

Brake modules

The brake modules are designed to provide the interface between the Control Module/Power Module and the brake solenoid of a motor. There are two versions:

- Brake module – this provides the basic braking control function.
- Safe brake module – this provides for the braking control function within a safety integrated system. To adhere to the requirements of a safety integrated system, the safe brake module has been designed to allow a variable voltage to be given to the safe brake module to allow the system to determine if the brake module is functioning correctly without actually activating the braking function.

The brake modules can be panel mounted, wall mounted or mounted on the screen termination plates and gland kits.

Ordering information is given in the following table:

Table 8-5 Brake module ordering information

Description	Order No.
Brake Module	6SL3252-0BB00-0AA0
Safe Brake Module	6SL3252-0BB01-0AA0

Chokes and filters

Class B, EMC filters

These external filters are fitted on the mains supply into the inverter and are used to suppress Radio Frequency Interference (RFI). To meet the requirements of Class B RFI emissions shielded cable should be used and must not exceed a maximum length of 25 m [82 ft] to 50 m [164 ft] – depending on the specific type of filter.

LC filters and sinusoidal filters

The LC filter and sinusoidal filter is designed to limit the rate of rise of voltage and the capacitive charge or discharge currents which usually occur with inverter operation. This means that much longer shielded motor cables are possible when using LC filters and sinusoidal filters and the service life of the motor achieves values similar to those with direct mains operation.

Line commutating choke (Input choke)

Line commutating chokes are used to smooth voltage peaks (line disturbances) or to bridge commutating dips. In addition, line commutation chokes reduce the effects of harmonics on the SINAMICS G120 power module and on the power supply. If the line impedance is less than 1 % (stiff supply) then a line commutation choke must be used to reduce the current peaks and to protect the SINAMICS G120 power module.

For more information on input chokes, please refer to the product catalog.

Output choke

Output chokes can be used to reduce the capacitive compensation currents and dV/dt in the case of motor cables greater than 50 m [164 ft] (shielded) or less than 100 m [328 ft] unshielded.

Ordering information is given in the following table:

Table 8-6 Choke and filter ordering information

Description	Order No.
G120/S120 FSB Class B Supp Filter	6SL3203-0BE21-6SA0
G120/S120 FSC Class B Supp Filter	6SL3203-0BD23-8SA0
G120/S120 FSB Input Choke (9.0 A)	6SL3203-0CD21-0AA0
G120/S120 FSB Input Choke (12.1 A)	6SL3203-0CD21-4AA0
G120/S120 FSC Input Choke (20.5 A)	6SL3203-0CD22-2AA0
G120/S120 FSC Input Choke (29.3 A)	6SL3203-0CD23-5AA0
G120/S120 FSD 400 V 18,5 kW Input Choke	6SL3203-0CD25-3AA0
G120/S120 FSD 400 V 22 kW Input Choke	6SL3203-0CJ24-5AA0
G120/S120 FSE 400 V Input Choke	6SL3203-0CJ28-6AA0
G120/S120 FSB Output Choke	6SL3202-0AE21-0CA0
G120/S120 FSC Output Choke	6SL3202-0AJ23-2CA0

Braking resistor

The braking resistor is designed for the SINAMICS G120 inverters with an internal brake chopper and enables loads with a large moment of inertia to be braked quickly. During braking of the motor and the load, excess energy is fed back to the inverter. This causes the voltage to rise in the DC link. The inverter transfers the excess energy to the externally mounted braking resistor. The option is only available for the Frame Size B inverter.

Ordering information is given in the following table:

Table 8-7 Braking resistor ordering information

Description	Order No.
G120/S120 FSB Braking Resistor	6SL3201-0BE12-0AA0

8.3 Brake Control Relays

Overview

There are two types of brake control relays:

- Relay Brake Module
- Safe Brake Module

The Safe Brake Module and the Relay Brake Module are different variants of the same device (for details see option description "Brake Module Instructions".

Connections of Relay Brake Module and Safe Brake Module:

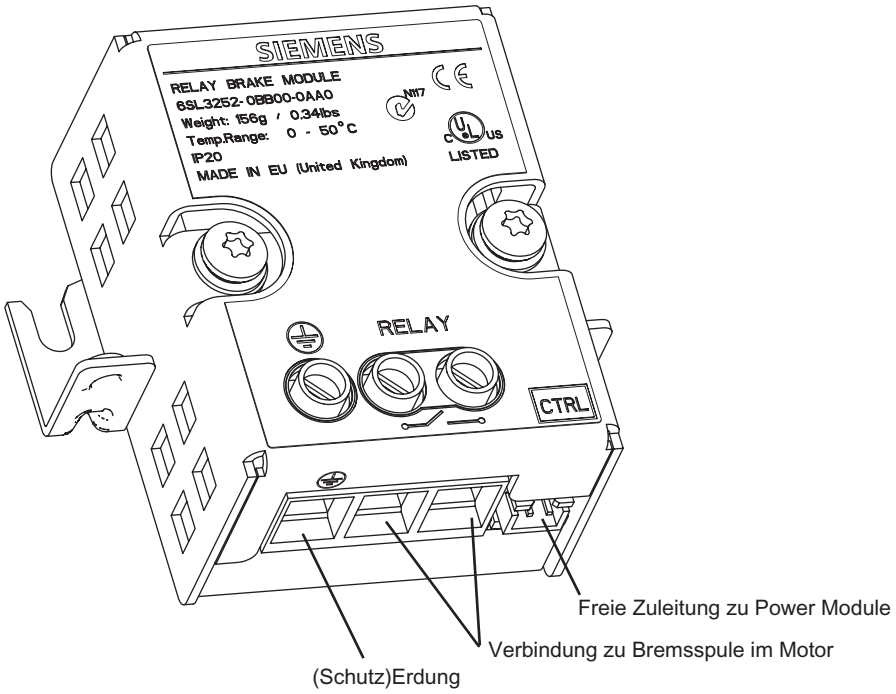


Figure 8-2 Relay Brake Module

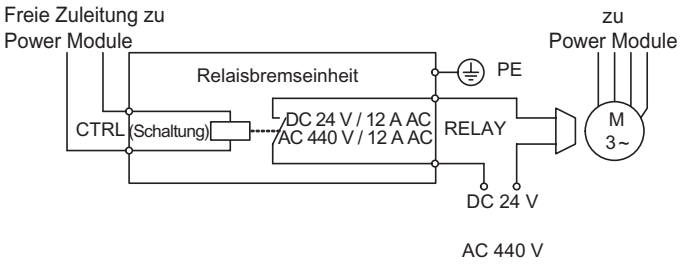


Figure 8-3 Wiring of Relay Brake Module

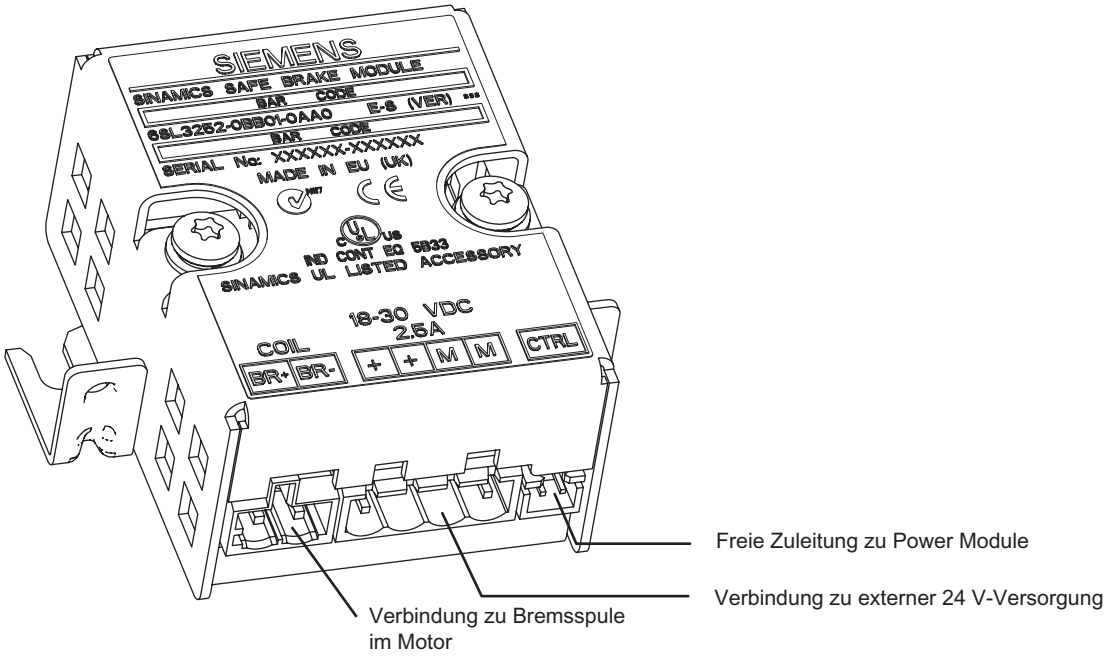


Figure 8-4 Safe Brake Module

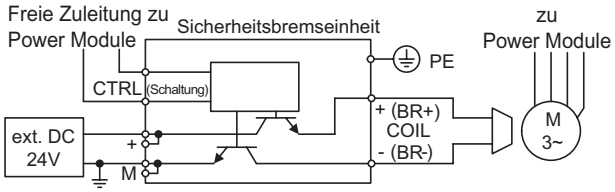


Figure 8-5 Wiring of Safe Brake Module

24 V motor brakes up to a current consumption of 2 A can be operated with the Safe Brake Module. Necessary is an external controlled power supply for 2.5 A and an output voltage which can be adjusted at a voltage of 26 V, e.g. SITOP modular. The higher voltage is required to compensate the voltage drop across the cables to the coil of the brake.

Note

On fail-safe reasons it is not allowed to take the 24 V supply of the Control Unit.
The power supply for the Safe Brake Module must be a separate additional power supply.

During power ON for the drive it is necessary to supply the Safe Brake Module first, so that the Control Unit is able to check its function, otherwise the fault F1601 will occur.

The Safe Brake Module is designed to reaction to a stepped voltage input, which allows the braking mechanism to be tested. The Relay Brake Module does not have this functionality.

Note

During forced dynamisation all connections of the Safe Brake Module are checked but in operation the connection between Safe Brake Module and brake coil is not monitored.

Triggering the Brake Control with non-safety Control Units

The motor brake function can be activated or deactivated via P1215. It controls a brake relay, connected to the power module. This brake relay controls an electro-mechanical brake, which is always closed when powered down.

P1215 = 0
(motor brake not active - factory setting), that means, if a brake is available, it will be closed to prevent the motor against unintended moves, e.g. after a parameter download.

P1215 = 1
(motor brake active) the brake will be controlled via terminals A and B on the power module.

Triggering the Brake Control with Fail-safe Contol Units

Prerequisite: P1215 = 1

Warning

The brake can be triggered via both, a Relay Brake Module and a Safe Brake Module. Triggering via a Relay Brake Module is not fail-safe!

For a fail-safe triggering of a Safe Brake Module the following parameters must be set: P9602 = P9802 = 1 (factory setting is 0). If P9602 ≠ P9802 a fault will be generated.

In case of P9602 = P9802 = 1 a test signal regarding the signal to the Safe Brake Control is generated and monitored.

This test signal does not interfere with the normal function of the mechanical brake. If the mechanical brake is fitted and the test fails, a fault condition will be indicated by the inverter.

If the Safe Brake Control is deactivated by setting P9602 = P9802 = 0 the Safe Brake Module will still work as intendet but will not be monitored in a safe way.

Appendix

A

A.1 Electromagnetic Compatibility

Electromagnetic compatibility

All manufacturers/assemblers of electrical apparatus which “performs a complete intrinsic function and is placed on the market as a single unit intended for the end user” must comply with the EMC directive EC/89/336.

There are three routes for the manufacturer/assembler to demonstrate compliance:

Self certification

This is a manufacturer's declaration that the European standards applicable to the electrical environment for which the apparatus is intended have been met. Only standards that have been officially published in the Official Journal of the European Community can be cited in the manufacturer's declaration.

Technical construction file

A technical construction file can be prepared for the apparatus describing its EMC characteristics. This file must be approved by a ‘Competent Body’ appointed by the appropriate European government organization. This approach allows the use of standards that are still in preparation.

EMC Standards

The SINAMICS G120 drives have been tested in accordance with the EMC Product Standard EN 61800-3:2004.

A.2 Definition of the EMC Environment and Categories

Classification of EMC performance

The EMC environment and categories are defined within the EMC Product Standard EN 61800-3, as follows:

First Environment

An environment that includes domestic premises and establishments that are connected directly to a public low-voltage power supply network without the use of an intermediate transformer.

Note

For example: houses, apartments, commercial premises or offices in a residential building.

Second Environment

An environment that includes industrial premises and establishments that are not connected directly to a public low-voltage power supply network.

Note

For example: industrial and technical areas of buildings fed from a dedicated transformer.

- **Category C1**

  Power Drive System (PDS) of rated voltage less than 1000 V intended for use in the First (Domestic) Environment.

- **Category C2**

  Power Drive System (PDS) of rated voltage less than 1000 V, which is neither a plug in device nor a movable device, and when used in the First (Domestic) Environment, is only intended to be installed and commissioned by a professional.

  Note

  A professional is a person or an organization having necessary skills in installing and/or commissioning a Power Drive System (PDS), including their EMC aspects.

- **Category C3**

  Power Drive System (PDS) of rated voltage less than 1000 V intended for use in the Second (Industrial) Environment and not intended for use within the First (Domestic) Environment.

Table A-1 Compliance Table

Model	Remarks
Category C1 - First Environment	
--	The SINAMICS G120 drives are not intended for use within the Category C1 Environment.
Category C2 - First Environment - Professional Use	
Filtered Variants 6SL3224-0BE**-*A*0	Drives FSB … FSF (400 V, 2.2 kW … 90 kW)
	All units (except FSA) with integral filter.
	Class A: 25 m screened cable type CY
	The FSA power variant (400 V, 370 W … 1.5 kW) requires either a footprint filter option (6SE6400-2FA00-6AD0) or additional power-line filtering at the "system level".
	When used in the First (Domestic) Environment this product may cause radio interference in which case mitigation measures may be required.
Category C3 - Second Environment	
Unfiltered Variants 6SL3224-0BE**-*U*0	All units are available as unfiltered variants.
	Drives FSA … FSF (400 V, 370 W … 90 kW)
	The use of unfiltered drives within an industrial installation is only possible if it forms part of a system which includes additional power-line filtering at the "system level" or, alternatively, the use of filtered variants.

Note

All drives should be installed and commissioned in accordance with the manufacturer’s guidelines and in accordance with good EMC practices.

For further information refer to SIEMENS application note “EMC Design Guidelines”.

A.3 EMC Overall Performance

EMC Emissions

The SINAMICS G120 drives have been tested in accordance with the emission requirements of the category C2 (domestic) environment.

Table A-2 Conducted & Radiated Emissions

EMC Phenomenon	Standard	Level
Conducted Emissions	EN 55011	Class A
Radiated Emissions	EN 55011	Class A

Note

To achieve this performance the default switching frequency should not be exceeded.

In order to achieve conducted emissions to EN 55011 Class B there is a range of PM240 external filter options available.

Achieving radiated emissions to EN 55011 Class B is largely dependent on the drive being correctly installed inside a metallic enclosure. The limits will not be met if the drive is not enclosed or installed in accordance with good EMC practices.

Harmonic Currents

The harmonic current emissions from the SINAMICS G120 drives is as follows:

Table A-3 Harmonic Currents

Rating	Typical Harmonic Current (% of rated input current)							
	5th	7th	11th	13th	17th	19th	23rd	25th
FSA … FSF (400 V, 370 W … 90 kW)	73	52	25	23	22	15	12	10

Note

Units installed within the category C2 (domestic) environment require supply authority acceptance for connection to the public low-voltage power supply network. Please contact your local supply network provider.

Units installed within the category C3 (industrial) environment do not require connection approval.

EMC Immunity

The SINAMICS G120 drives have been tested in accordance with the immunity requirements of category C3 (industrial) environment:

Table A-4 EMC Immunity

EMC Phenomenon	Standard	Level	Performance Criterion
Electrostatic Discharge (ESD)	EN 61000-4-2	4 kV Contact discharge	A
		8 kV Air discharge	
Radio-frequency Electromagnetic Field	EN 61000-4-3	80 MHz … 1000 MHz 10 V/m	A
Amplitude modulated		80 % AM at 1 kHz	
Fast Transient Bursts	EN 61000-4-4	2 kV @ 5 kHz	A
Surge Voltage	EN 61000-4-5	1 kV differential (L-L)	A
1.2/50 µs		2 kV common (L-E)	
Conducted	EN 61000-4-6	0.15 MHz … 80 MHz 10 V/rms	A
Radio-frequency Common Mode		80 % AM at 1 kHz	
Mains Interruptions & Voltage Dips	EN 61000-4-11	100 % dip for 3 ms	A
		30 % dip for 10 ms	B
		60 % dip for 100 ms	C
		95 % dip for 5000 ms	D
Voltage Distortion	EN 61000-2-4 Class 3	10 % THD	A
Voltage Unbalance	EN 61000-2-4 Class 3	3 % Negative Phase Sequence	A
Frequency Variation	EN 61000-2-4 Class 3	Nominal 50 Hz or 60 Hz (± 4 %)	A
Commutation Notches	EN 60146-1-1 Class B	Depth = 40 %	A
		Area = 250 % x degrees	

Note

The immunity requirements apply equally to both filtered and unfiltered units.

A.4 Standards

European Low Voltage Directive

The SINAMICS G120 product range complies with the requirements of the Low Voltage Directive 73/23/EEC as amended by Directive 98/68/EEC. The units are certified for complaince with the following standards:

EN 61800-5-1 — Semiconductor inverters –General requirements and line commutated inverters

EN 60204-1 — Safety of machinery –Electrical equipment of machines

European Machinery Directive

The SINAMICS G120 inverter series does not fall under the scope of the Machinery Directive. However, the products have been fully evaluated for compliance with the essential Health & Safety requirements of the directive when used in a typical machine application. A Declaration of Incorporation is available on request.

European EMC Directive

When installed according to the recommendations described in this manual, the SINAMICS G120 fulfils all requirements of the EMC Directive as defined by the EMC Product Standard for Power Drive Systems EN 61800-3

Underwriters Laboratories

UL and CUL LISTED POWER CONVERSION EQUIPMENT for use in a pollution degree 2 environment.

Note: UL certification is presently in progress.

ISO 9001

Siemens plc operates a quality management system, which complies with the requirements of ISO 9001.

List of abbreviations

B

Abbreviations used with the SINAMICS G120 Products

Table B-1 Abbreviations used with the SINAMICS G120 Products

Abbreviations	State
A	
AC	Alternating Current
A/D	Analog digital converter
ADR	Address
AFM	Additional frequency modification
AG	Automation Unit
AI	Analog input
AK	Request Identifier
AO	Analog output
AOP	Advanced operation panel
ASIC	Application-specific integrated circuit
ASP	Analog setpoint
ASVM	Asymmetric space vector modulation
B	
BCC	Block check character
BCD	Binary-coded decimal code
BI	Binector input
BIA	Berufsgenossenschaftliches Institut für Arbeitssicherheit
BICO	Binector/connector
BO	Binector output
C	
C	Commissioning
CB	Communication board
CCW	Counter-clockwise
CDS	Command data set
CI	Connector input
CM	Configuration management
CMD	Command
CO	Connector output
CO/BO	Connector output/Binector output
COM	Common (terminal is connected to NO or NC)

Abbreviations	State
CT	Commissioning, ready to run
CU	Control Unit
CUT	Commissioning, run, ready to run
CW	Clockwise
D	
D/A	Digital analog converter
DC	Direct current
DDS	Drive data set
DI	Digital input
DIP	DIP switch
DO	Digital output
DP	Distributed I/Os
DP-V1	Acyclic data transfer (extended PROFIBUS function)
DS	Drive state
E	
ECD	Equivalent circuit diagram
EEC	European Economic Community
EEPROM	Electrical erasable programmable read-only memory
ELCB	Earth leakage circuit breaker
EMC	Electromagnetic compatibility
EMF	Electromagnetic force
ES	Engineering System
FAQ	Frequently asked question
F	
FB	Function block
FFB	Freely Assignable Function block
FCC	Flux current control
FCL	Fast current limiting
FF	Fixed frequency
FFB	Free function block
FOC	Field orientated control
FREQ	Frequency
FSA	Frame size A
FSB	Frame size B
FSC	Frame size C
FSD	Frame size D
FSE	Frame size E
FSF	Frame size F
G	
GSD	Device Data File (Geräte Stamm Datei)
GSG	Getting Started Guide
GUI ID	Global unique identifier

Abbreviations	State
H	
HIW	Main actual value
HMI	Human machine interface
HO	High Overload (Constant Torque)
HSW	Main setpoint
HTL	High-voltage transistor logic
I	
I/O	In-/output
IBN	Commissioning
IGBT	Insulated gate bipolar transistor
IND	Sub-index
J	
JOG	JOG
K	
KIB	Kinetic buffering
L	
LCD	Liquid crystal display
LED	Light emitting diode
LGE	Length
LO	Light Overload (Variable Torque)
LWL	Fiber Optic conductor
LSTO	Latched Safe Torque Off
M	
MHB	Motor holding brake
MLP	Multi-Language Pack
MOP	Motor operated potentiometer
N	
NC	Normally closed
NEMA	National Electrical Manufacturers Association
NO	Normally open
O	
OLM	Optical Link Module
OLP	Optical Link Plug
OM	Object Manager
OP	Operator Panel
OPI	Operating Instructions
PA	
PID	Proportional, integral, derivative controller
PKE	Parameter ID
PKW	Parameter ID value area (Parameterkennung Wert)
PLC	Programmable logic control
PM	Power module

Abbreviations	State
PM-IF	Power module interface
PNU	Parameter Number
PNO	PROFIBUS Nutzerorganisation
PPO	Parameter process data object
PTC	Positive temperature coefficient
PWE	Parameter value
PWM	Pulse-width modulation
Pxxxx	Write parameter
PZD	Process data area (Prozeßdaten)
Q	
QC	Quick commissioning
R	
RAM	Random-access memory
RCCB	Residual current circuit breaker
RCD	Residual current device
RFG	Ramp-function generator
RFI	Radio frequency interference
ROM	Read-only memory
RPM	Revolutions per minute
rxxxx	read-only parameters of analogue signals
S	
SBC	Safe Break Control
SLVC	Sensorless vector control
SLS	Safe-Limited Speed
SOL	Serial option link
SS1	Safe Stop 1
STO	Safe Torque Off
STW	Control word
STX	Start of text
SVM	Space vector modulation
T	
TTL	Transistor-transistor logic
U	
USS	Universal serial interface
V	
V/f	Voltage/frequency
VC	Vector control
VT	Variable torque
W	
WEA	Automatic restart
Z	
ZSW	Status word

Abbreviations	State
ZUSW	Additional setpoint

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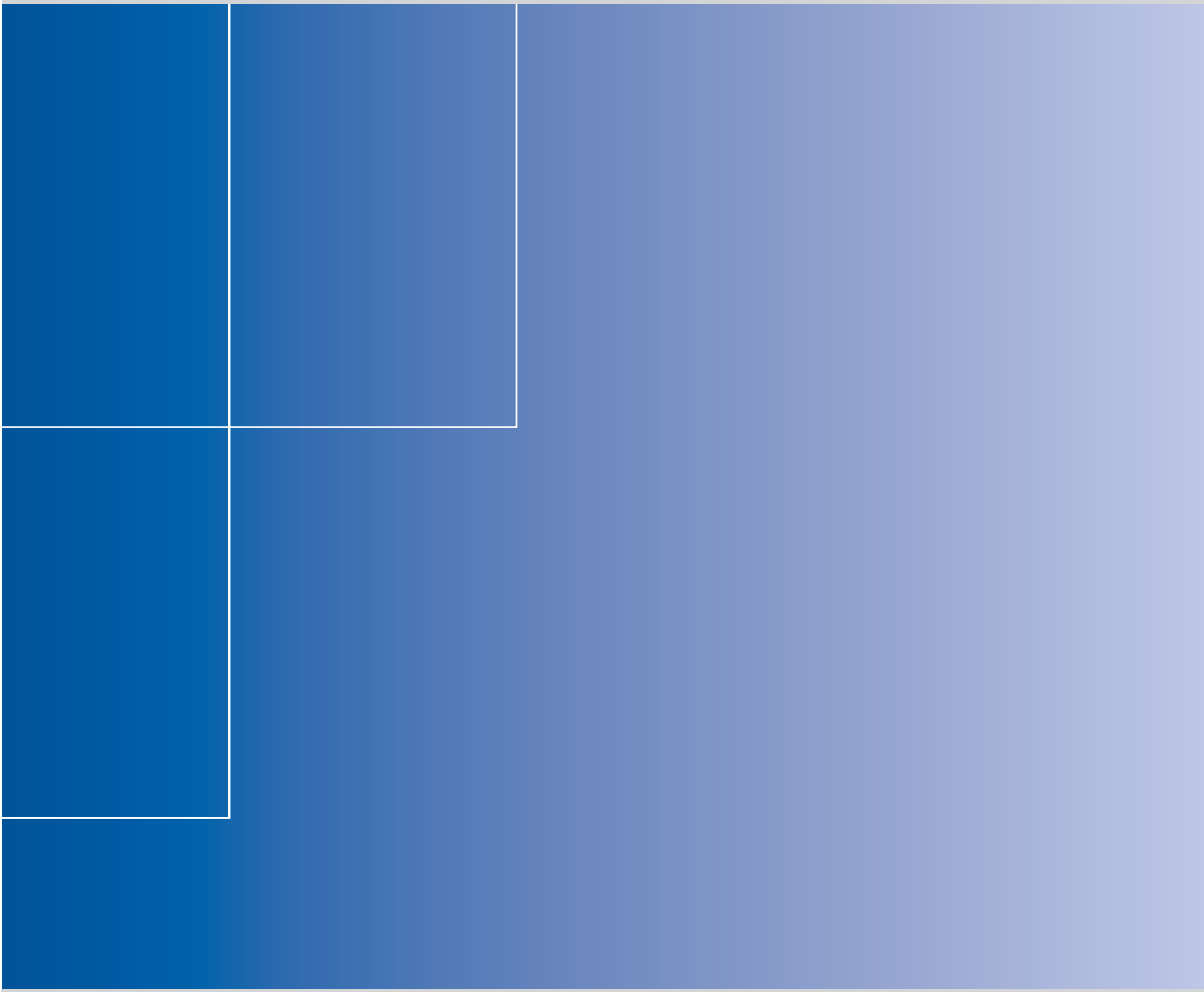

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